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The Journal of the Biological Photographic Association

Official Publication of the Biological Photographic Association Inc.

VOLUME 9 NUMBER 1

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September, 1940

PUBLISHED QUARTERLY FOR THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION INC. AT 1300 NATIONAL AVE., WAUKESHA, WIS.

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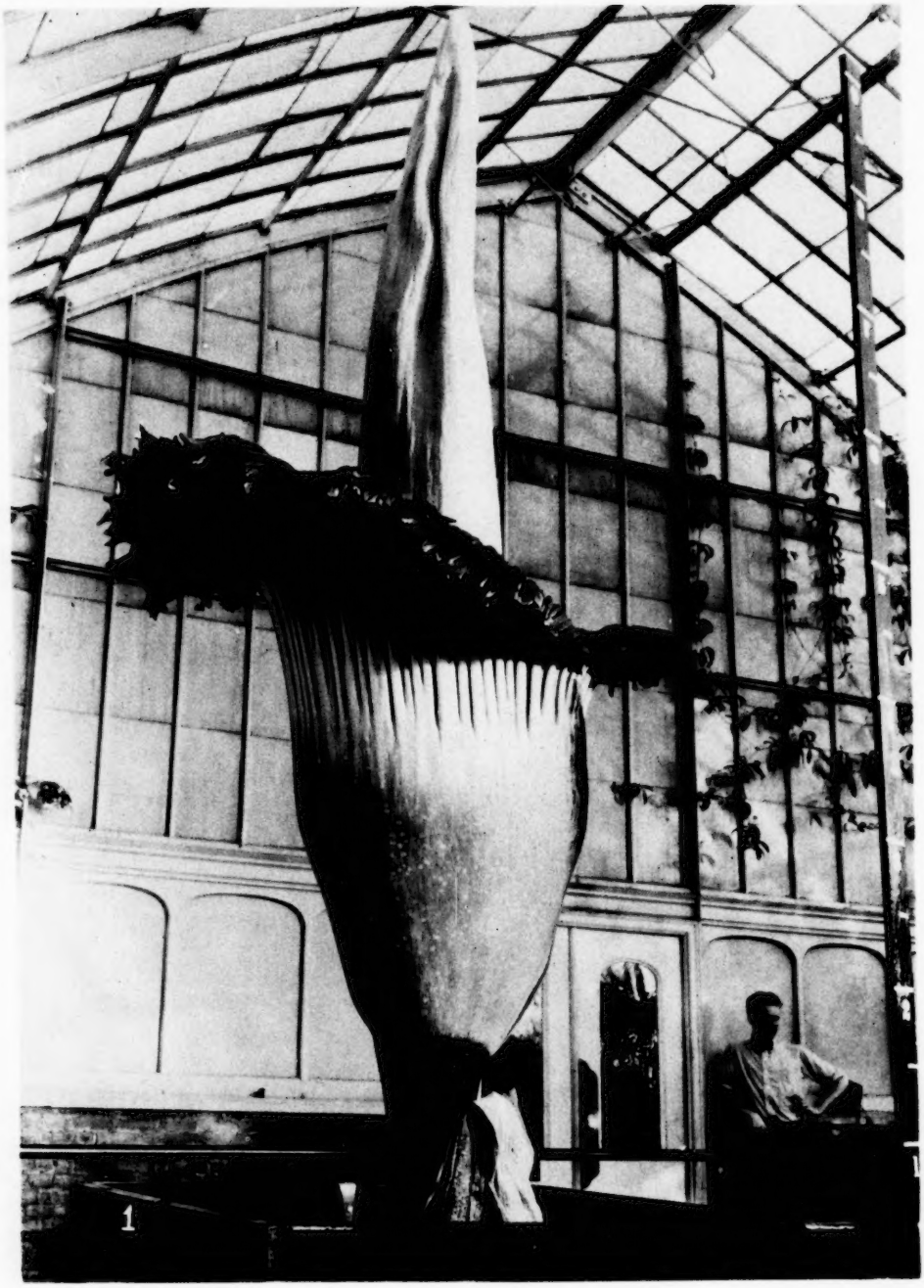
PUBLISHED QUARTERLY FOR THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION INC. AT 1300 NATIONAL AVE., WAUKESHA, WIS.

Subscription price $3.00 per volume. Single copies 75 cents.

Entered as second-class matter at the Post Office at Waukesha, Wis., under the act of March 3, 1879.



The Journal of the
Biological Photographic Association

Volume 9 September, 1940 Number 1

PHOTOGRAPHING WHAT WE SEE

FLEDA GRIFFITH*

WHEN I became a member of the New York Botanical Garden's staff, I was given an assignment with the question, "Can you photograph this?" My answer was, "Anything we can see can be photographed." Ever since, I have been trying to make good on that statement, and have often failed. The reasons are simple yet involved.

We take it for granted that a good camera with the right lens for the job in hand, a working knowledge of films, appropriate printing papers, and a dependable dark room technic will produce results, and so they do; but not always the results that are expected. There is something in addition to all this that spells success or failure, whether the subject be pictorial or strictly scientific.

At the New York Botanical Garden the work is varied; it includes color photography and the taking of motion pictures throughout the garden, the making of photographic records of new flowers and of herbarium specimens, and the recording of experiments in pure science. Most of our work has a scientific aspect.

In these different fields I have found that the first step toward a

* Received for publication July 27, 1940. Photographer and Artist, New York Botanical Garden.

EXPLANATION OF FIGURE 1.

The giant Amorphophallus, or "Krubi," largest inflorescence in the world, which bloomed for the first time in the western hemisphere in June 1937 at the New York Botanical Garden. Making a complete photographic record of the flowering of this 8½ foot specimen required constant vigilance and more than one trick in technic.

successful photograph is a thorough understanding of what someone expects it to show; the next is to make the lens see it too.

The first hurdle, then, is that of "seeing." No two of us see exactly alike. Our different interests and training cause us to see in a given subject the point in which we are interested, and to ignore or to be unconscious of everything else. As opposed to the eye, the lens "sees" literally and without emphasis everything in its field and within its limits. With these facts the photographer must always reckon.

A recent experience gives a good example of this. A member of our staff in writing a magazine article on roses wanted photographs for illustration. He brought to the studio some lovely new varieties. They were all beauties and, he thought, just what he wanted for his illustrations; but not all could be used. One, a glorious new shade of red, claimed distinction for its compelling color, on which all interest was focused to the exclusion of the fact that it had a torn petal in too prominent a position to be hidden from the lens of a camera. Another had petals slightly bug-eaten. Such specimens could not be satisfactorily photographed, because the defects, so unconsciously eliminated in the mind of the admirer of the real rose, would be recorded faithfully by the camera and would assume importance in a black and white print. The picture is spoiled by the defect although the rose itself suggests perfection.

EXPLANATION OF FIGURES

Figure 2. A rose, perfect in flower and leaf, and therefore an acceptable subject for photography. The lighting brings out the texture of petals and leaf surfaces and gives the effect of a third dimension in the picture.

Figure 3. Petunia buds with the lighting thrown on the gland-tipped hairs.

Figure 4. Leaf patterns and flower-heads gone to seed often have their artistic as well as their scientific values.

Figure 5. An Iris flower lighted in such a way as to bring out the subject desired — the stamen curved above the beard of the petal.

Figures 6 and 7. Two photographs of the same subject, the under side of a leaf of *Victoria regia,* the Royal Waterlily of the Amazon. It was this structure which inspired the design of the Crystal Palace in London some 90 years ago, and which has since then influenced the architectural pattern of glass conservatories. One photograph here serves merely as a technical record. The other shows the same leaf inverted in the water, with the reflection of the greenhouse dome carrying out the pattern of the leaves.

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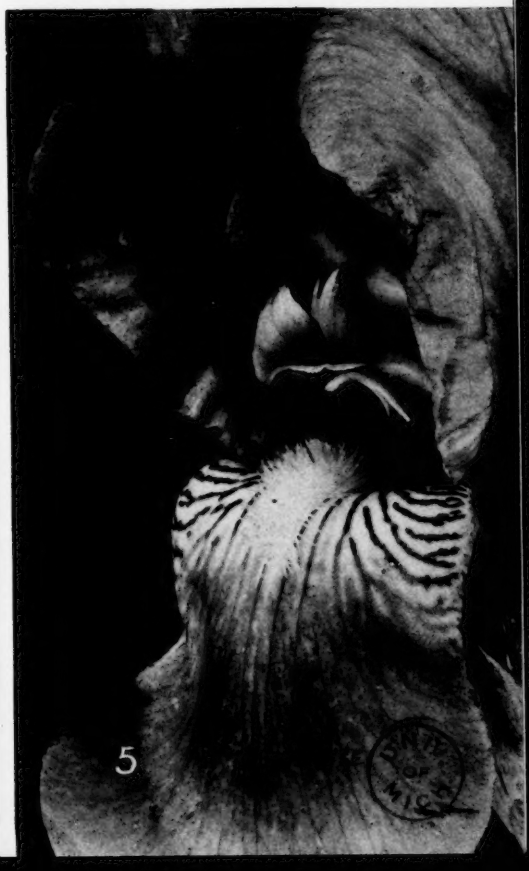

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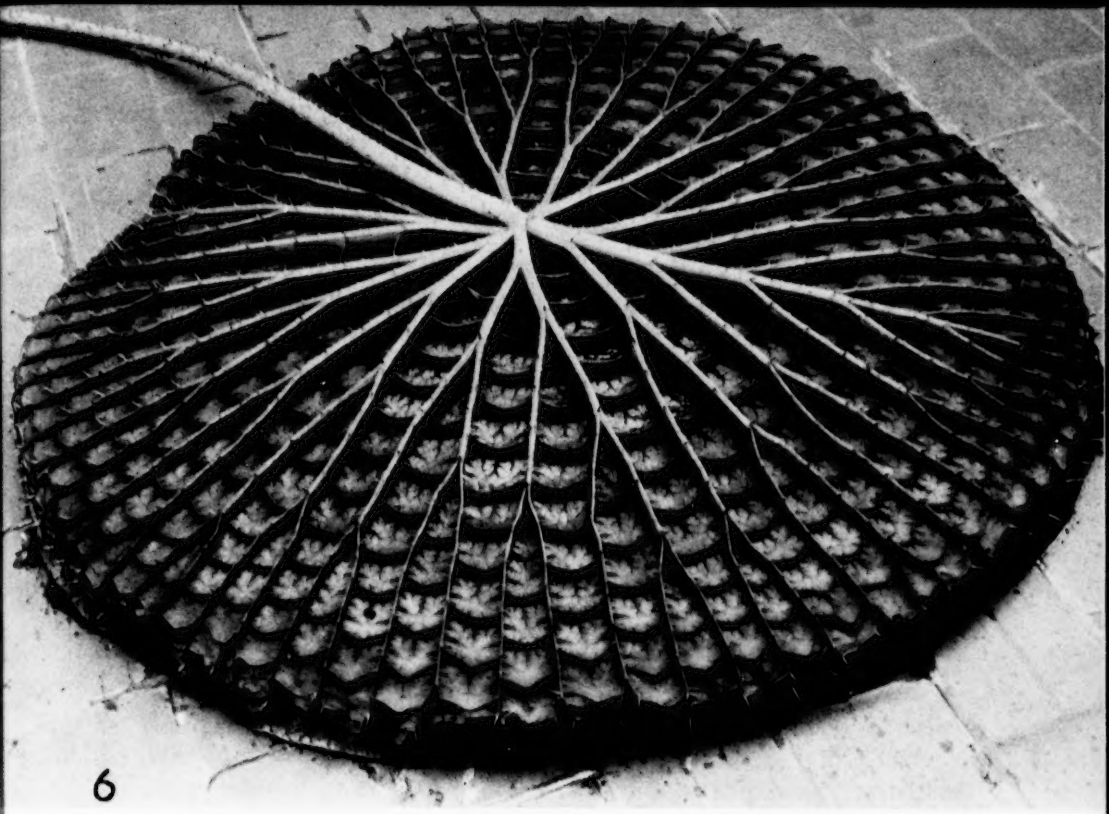

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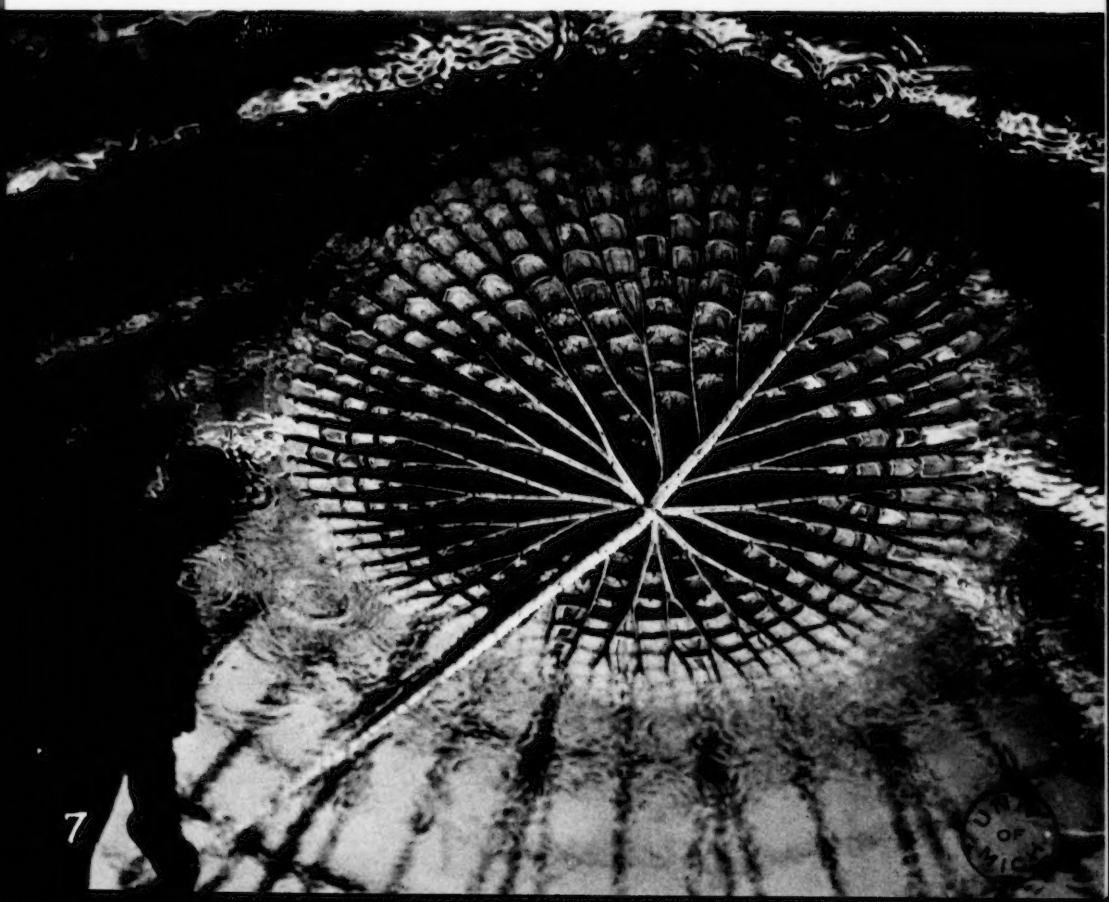

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In photomicrography likewise, the lens, without imagination to give emphasis to what it sees, is literal in what it portrays. The scientist sees on the slide in his microscope what the camera can not always be made to record. With one hand on the fine adjustment he skillfully obtains a clear and brilliant image of chromosomes or spores or pollen grains or whatever may be the subject of his investigation. Satisfied that he has exactly what he wants photographed for his record, he fails to see what else there may be in the field of vision besides the perfect specimen. Perhaps it is a bit of foreign matter or a bubble, and the photographer knows that if it is in the field of vision it will assume as much importance as the specimen itself. Also, because there is no continually varying fine adjustment on a camera which would enable it to keep in perfect focus material on different levels, as does the fine adjustment of the microscope, a photograph often fails to satisfy the scientist.

The second hurdle of making the camera see what an individual sees is indeed a difficult one to surmount. In photomicrography little can be done except to attempt the best technical job possible. However, in all other fields of photography much can be done in addition to making a good technical job; *how* much depends upon the imagination, ingenuity, and skill of the photographer, and especially upon his knowledge and use of light. When the plant pathologist brings material into the studio, he may want to make insects feeding on a leaf stand out clearly, showing how they go about their work of destruction, or just the opposite — how protective coloring makes them so inconspicuous that they almost escape notice. It is largely the method of lighting that enables the photographer to show what is important to the scientist.

No matter how fine the equipment used or how beautiful the subject given to work with, the difference between a successful picture that tells a story, that gets across an impression as it appears to the human eye, and the unsuccessful picture that fails to give the desired impression or idea, may well be due to the expert use of light. An indefinable something that seems to suggest the beauty and charm of the original can be brought out in a photograph by clever lighting. What would otherwise be a dull, uninteresting form or pattern in black and white can be made to come alive, to sparkle. Many times, bad form or outline can be made so inconspicuous as to be unnoticeable by focusing attention on the best features of the subject through the lighting effect.

With light we can give form and variety and accent. There is almost no limit to the interesting things that can be accomplished through a study and use of light in photography. It is a fascinating subject to

pursue and is well worth the time and patience to work out each individual problem. The challenge to the photographer grows ever more compelling as he finds what things can be accomplished. There is always adventure and the thrill of attainment when successful. It seems to me it is through the use of light that one can come the nearest to making it possible to photograph "anything one can see."

EXPLANATION OF FIGURES

Figures 8 and 9. Cultures of two fungi which cause a fatal disease of Delphinium. The American Delphinium Society is providing a scholarship by means of which Delphinium diseases are being studied at the New York Botanical Garden, and the Garden's photographic department is making records of the research. Photograph by courtesy of Mr. Thomas Laskaris.

Figure 10. Near the base of the spathe of the Amorphophallus, just a little way above the dark "stem," a window was cut in order that scientists might study the male and female flowers hidden within. The interior was illuminated by sunlight shining through the translucent wall of the spathe.

Figure 11. Plant pests — the subject most in demand by the Plant Pathology department. Sometimes the pest itself or its effect must be brought out in clear relief; sometimes the object of the photograph is to show how the pest hides itself by protective coloring or form.

Photographs by courtesy of the New York Botanical Garden except where otherwise indicated.

THE WOMEN

One of our members who read the statistics published about the Association in the March Journal wrote us that he wished we had added an item telling how many women we had among our members. For his information, and yours, 41 of our members are women. This is 14% of our membership, a fraction large enough to prove that scientific photography under many circumstances offers a promising field to women.

Thirteen of our women-members are in charge of photographic departments in scientific institutions; 8 are scientists; 13 are technicians; 3 are medical artists who also take pictures; 1 is in a commercial photographic concern; 1 is a professional free-lance photographer, and 2 are amateurs.

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SOME NOTES ON PHOTOGRAPHY OF THE ALBINO RAT

NATHAN S. HORTON*

THE title of this paper aptly describes its contents — just a few notes. An article covering all factors entering into photography of the white rat would be very lengthy, for one would have to deal with every phase of photography from X-Ray to infra-red. Although photography of the experimental animal in the laboratory parallels, in many respects, actual clinical photography, the problems often become quite involved because of the size, and, in the case of live animals, the restless activity and color (or, one might say, the lack of it).

Our problem has been something more than the "straight" photographic recording of certain laboratory work. Many of our photographs are made for the sole purpose of illustrating medical literature, or exhibits at medical gatherings and, therefore, must not only be technically correct but must present the material in such a way that the photographs "tell the story." The photographic requirements of laboratories vary, of course, with the type of work being done. In our laboratory, photography has proved of particular value in recording and illustrating various phases of assays on the vitamins, estrogenic substances, and the gonadotrophic hormones.

Photographing the "Live" Animal

Depth of Focus: In photographing the live and moving rat one of the most annoying problems is maintaining adequate depth of focus. This problem has been solved in a reasonably satisfactory manner by the use of a glass enclosure. This enclosure or stage is approximately six inches wide, eighteen inches long, and about twelve inches high. The front and the two end pieces are made of double-diamond glass and the back section is arranged so that it is interchangeable. Either clear glass, ground glass or any color of background can be used, depending on the effect desired. Such a piece of equipment limits the movement of the rat so that a reasonably large aperture may be used. A rough diagram is shown as figure 1.

It is not unusual to see photographs of rats in which the rat is either held in the hand or fastened by wire to the table. Although this quickly

* Received for publication May 17, 1940. Ayerst, McKenna & Harrison U. S. Limited, Rouses Point, N. Y.

and easily solves the problem of depth of focus, it seems to give an unnaturalness to the illustration which is, in our opinion entirely undesirable. It is suggested that this should not be resorted to, except when no other method can be applied.

In the case of such vitamin-deficiency diseases as polyneuritis

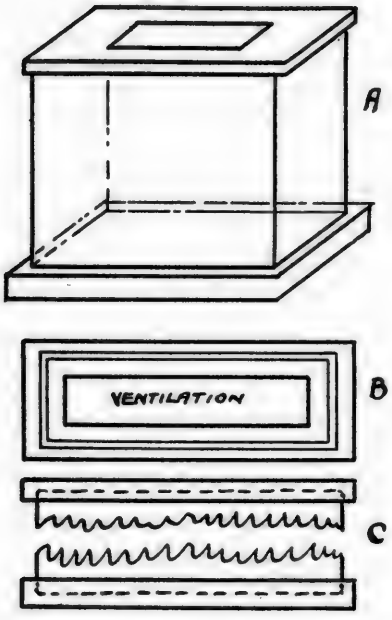

FIG. 1

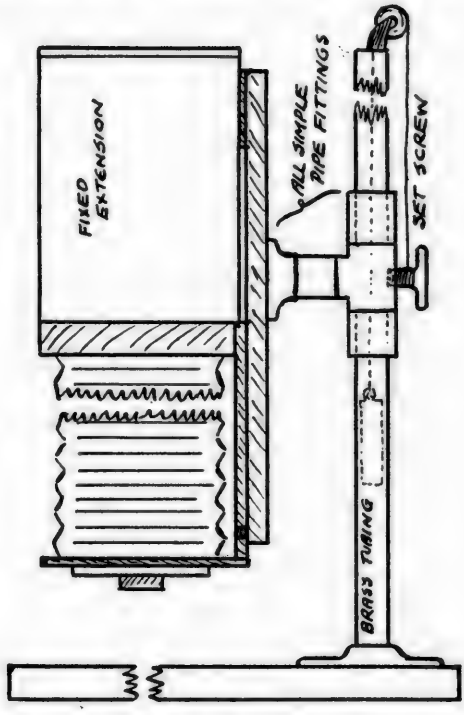

FIG. 2

Figure 1 shows the construction of the enclosure or stage device for confining movement of the animal. "A"—the assembled enclosure. "B"—top piece showing rabbets to hold slides in place and cut-out section for ventilation. "C"—side view showing how glass sets in rabbets.

A glass top, with small wood channels, could be substituted for the wood top. Metal or wood braces can also be used.

Figure 2. A rough diagram of the long-extension camera. With the exception of the sliding arrangement on the brass column it is fairly easy to construct. The upright column and sleeve are brass tubing. The sleeve fits into a collar with a threaded opening, into which is fitted the extension tube to the base of the camera. Counterbalancing is obtained by means of a flexible wire which passes over a pulley to the weight *inside* the tubing.

(Vitamin B_1 deficiency) the stage described above is not quite so suitable. A rat in the last stages of polyneuritis is in almost continuous convulsive movement in which it rolls from side to side, sometimes turning completely over several times. By placing the animal on a twelve inch diameter circle, supported about two inches above the table, the animal has room to roll around, and the depth of focus can be predetermined. With the Leica, a series of shots can be made, out of which one is bound to find several that illustrate the convulsive movements. Obviously, the lighting must be quite intense. Even though lack of contrast may result from the use of powerful flood lighting, this really does not seem to matter so much, because the desired result is one of stopping movement rather than obtaining tone quality.

Lighting: With the glass-enclosed stage described in the preceding paragraph, reflection from the glass may sometimes cause trouble. Harsh or "raw" lighting seems to produce the best results, not only in the use of this piece of equipment, but also in most all photography of the rat as well. On some occasions we have found that a Pola-screen is useful. Another difficulty, even when using present high speed film, is to obtain sufficiently powerful illumination to permit shutter speeds of one-sixtieth of a second or even faster. Although we have tried powerful flood lighting in some work with experimental animals, we have found that such lighting tends to flatten contrast to the point where the final effect is not by any means pleasing. The almost pure white of the rat makes it difficult to obtain any tone values at best, and powerful flood lighting only makes matters worse. Much could be written on this subject, but a good exposure meter can take care of the situation much better than a thousand words.

If the experimental animal can be photographed in full sunlight, the problem of illumination is automatically simplified, as a match light can be used to balance any deep shadows. However, for those who might be contemplating such photography, it is timely to warn them to procede very cautiously regarding the taking of animals into the open air. An experimental animal is not a very good risk when removed from the air-conditioned security of the laboratory.

Photographing the Rat as a "Still-Life" Subject

Anesthetizing the animal is one procedure that ensures the work being turned out in the best possible manner as regards focus, sharpness, etc. Unfortunately, inasmuch as a great many, if not most of the

animals exhibiting vitamin deficiencies are in rather precarious health, anesthetizing is often fatal. Regardless of the photographic results the photographer is not altogether popular if an animal, exhibiting a well-developed case of xerophthalmia, does not come out of the anesthetic.

If one can anesthetize the animal successfully, results, however, are pretty well assured, particularly in the case of such a condition as xerophthalmia. Figure 5 is an example of a shot made under these conditions.

A piece of home-made equipment essential for the making of such illustrations as that of the xerophthalmia is shown by the diagram in figure 2. The set-up consists of a 5 x 7 camera to which has been added a fixed extension of about 12 inches. The double extension of the camera, together with the fixed extension, gives a total of over 30 inches. On a 5 x 7 area, this of course, means that considerable enlargement can be obtained with the camera. We use 2, 3½ or 4 inch lenses, depending on the degree of enlargement desired. The camera itself slides up and down on a brass tube which is fastened rigidly to the baseboard and is counterbalanced for smooth adjustment.

This apparatus was developed particularly for the photography of certain organs *in situ,* although it is ideally suited for any large-scale work. In assay and experimental work with gonadotrophic hormones, the growth of the ovaries and uterus are indications of the effects of the hormone injected, and the large-scale photographs illustrate very clearly the actual growth response. The organs shown in figure 3 and 4 are enlarged many times; the original protographs were 5 x 7 contact prints. For lighting we have found that the small overloaded-filament type lamps provide an excellent light source, although any spotlight with a concentrated beam may serve the purpose.

Surgical procedures such as hypophysectomies and ovariectomies present another problem in equipment. As in the hospital operating theatre, the photographer must devise some means of obtaining a large image without interfering with the work of the surgeon, and, in the recording of these "miniature" operations on the rats, the work is made more difficult by the very small area to be recorded. A telephoto lens, or at least a 90 mm. lens, is necessary. A rigid ladder-arrangement will permit the photographer to use the camera at a 45 degree angle—an angle that is suitable for most work.

Another arrangement that can be used when a series of pictures must be made, is to fasten the camera on an overhead support. The

FIGURE 3

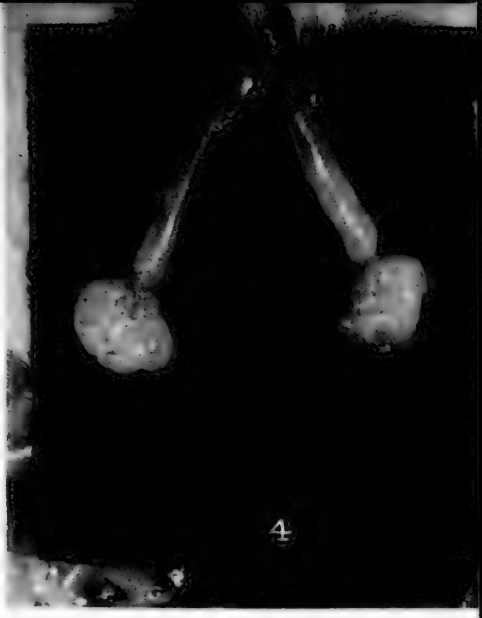

FIGURE 4

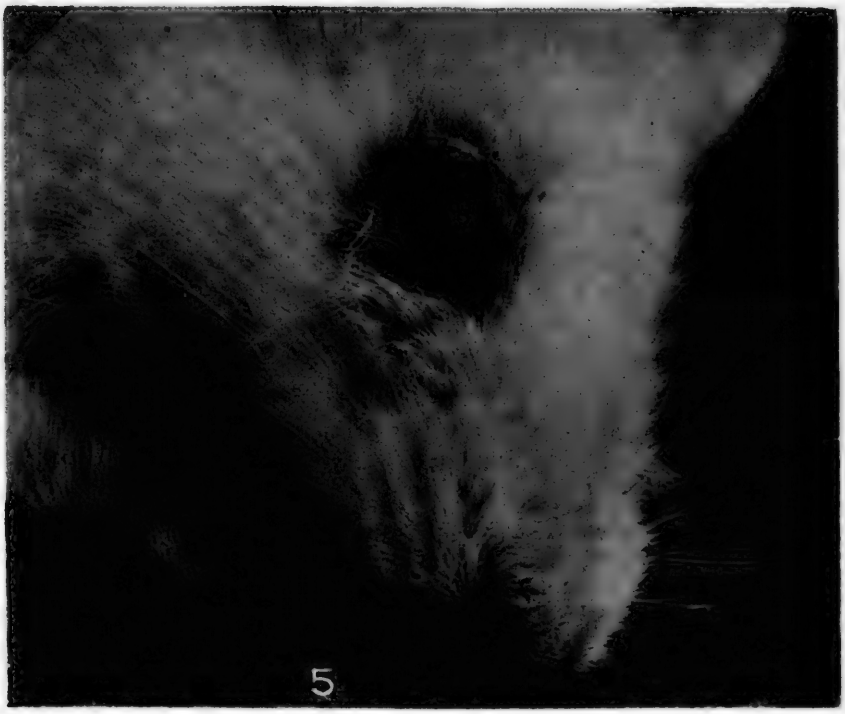

FIGURE 5

FIGURES 3 and 4, show the ovaries and horns of the uterus *in situ*. A small bit of cardboard is slipped under the organs for the purpose of providing a background and also to facilitate paralleling subject matter with the focal plane. Although the organs are many times enlarged, neither maximum camera extension nor the shortest focus lens was used. Made with an Elmar 90 mm. Leitz lens on Agfa Commercial Pan 5 x 7.

FIGURE 5 shows a well-developed case of xerophthalmia. This picture was made with a 5″ lens, as it was desired to show the head. Another shot made with a 2″ lens, of the eye only, resulted in tremendous enlargement, but of course only the centre of the eye was sharp.

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operating table is made immovable and the animal fastened in place. The camera is then placed in the desired position, focused and the operation proceeds. By means of a long cable release the pictures can be made at suitable moments and without the admitted annoyance of the photographer's proximity. For most surgical work a miniature such as the Leica seems to be ideal, permitting as it does, whole series of pictures. Where one particular step is all that is desired, a larger camera might be used to obtain maximum detail.

The Use of the Movie Camera as an Adjunct to General Laboratory Photography

The movie camera certainly has a valuable place in recording various laboratory activities. On frequent occasions, medical and pharmaceutical groups make inspection tours of our laboratories. Naturally, it is not always possible to show these visitors every phase of the work; ovariectomies and hypophysectomies are difficult to demonstrate to a group, and the experimental animal is not always obliging enough to develop certain vitamin deficiency diseases when visitors arrive. In an endeavour to explain the operations of the laboratories in the fullest possible manner, we are planning a rather comprehensive film to show, in detail, the work which cannot always be shown when inspection tours are made. The surgical operations described above are particularly suitable for movies and the vitamin B_1 deficiency, known as polyneuritis, can be clearly demonstrated only by motion pictures. There are many other laboratory procedures that lend themselves to motion picture rather than to still camera work. In most cases we have found color to be desirable and well worth the extra cost.

As a closing paragraph to these notes it might be well to again mention that photography of the rat covers practically every phase of photography. Because of this fact, no attempt has been made to go into details regarding films, development, lighting, or other problems which the experienced biological photographer can solve according to the results desired. The main difficulty is to devise set-ups that permit quick work, and that suggest semi-permanent equipment that can be kept in the laboratory. If it is necessary to set up the camera and tripod, and arrange the illuminating units every time a shot is required, the time and temper of both photographer and laboratory workers is needlessly expended.

FERROTYPE PLATE RACK AND PRINT DRYER

WILLIAM J. MADDEN*

The stand illustrated serves a double purpose:

1. A safe place to keep chromium plates when not in use.
2. An effective drying rack for glossy prints.

It is inexpensive and easily made. The model has a base of 24 by 24 inches and is 40 inches high. It will hold twelve 14 x 20 plates. It costs about $3.50 to construct.

The frame and cross pieces are made of wood. The shelving or drying surface is 40 inch curtain scrim doubled to 20 inches for strength and firmness.

Frame 1 x 1 inches (about thirty feet needed.)

Cross pieces ½ x 1 inches (about forty-eight feet needed.)

Ten yards fine mesh curtain scrim.

Thumb tacks are used for fastening at the top and bottom.

To dry prints, place chromium plate face down on scrim shelving. Air from below will permit drying, and the weight of the plate will keep print flat; no cracks or curling result.

* Received for publication July 18, 1940. Sea View Hospital, Staten Island, Department of Hospitals, City of New York.

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Ferrotype-plate rack and print dryer.

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PHOTOGRAPHING LIVE REPTILES AND AMPHIBIANS IN THE LABORATORY

ARTHUR L. SMITH*

A LARGE number of scientific laboratories have occasion to make photographs of live reptiles and amphibians. The purposes for which they are made includes taxonomic illustrations for texts, descriptions of new species, slides for educational purposes, and so forth. Due to the requirements of standard scientific work it is desirable that the pictures be of good specimens that are alive and alert. The utmost in photographic detail should be obtained. Even with proper equipment the photographing and handling of live reptiles and amphibians create many unusual problems. This paper is not written with the idea of great revelations in technic, but rather because in this laboratory, we have had such good success with the methods which we have adopted. There have been a great many excellent photographs made of reptiles and amphibians. The majority of these are the work of various taxonomic authorities in this field. Any one familiar with the literature of herpetology will find that although there are a large number of excellent photographs of some animals, there is a definite need of good pictures of others. Thus I would like to describe our experiences here in this laboratory for the benefit of those individuals who are seeking information on laboratory photography of herpetological specimens.

First of all, to dispose of the question — "why not photograph the animals outdoors in their natural habitat?" The answer to this question is dependent upon individual requirements. If it is absolutely necessary that natural habitat be present then there is no alternative than to seek the animal outdoors. If the animal characters alone are most important, then natural surroundings are apt to veil some of the important details. Another factor which often regulates the selection of background is the availability of the animal in outdoor surroundings. It is quite uncommon that any animal of the herpetological group is found in a natural habitat, photographically accessible, and willing to pose. Of course there are times when, by chance, an animal is found that can be photographed outdoors, but most individuals do not have the time nor the opportunity to make extensive field trips in search of animals thus situated. Therefore, when possible, it seems advisable to bring the animals into the laboratory where they may be photographed more conveniently. Desirable

* Received for publication July 26, 1940. Department of Zoology, Cornell University, Ithaca, N. Y.

illumination and pose may also be obtained more satisfactorily in the laboratory. This paper will attempt to describe only laboratory technics which, in our own case, we use almost exclusively. While there is a great deal of work being done with motion pictures in this field, the material in this article applies particularly to still photographs in black and white and in color.

The securing of live specimens is, of course, the problem of the individual laboratory. It is naturally desirable to obtain specimens which are in good condition, show characteristic markings, and appear typical of their species. We have undertaken the photography of every obtainable species of reptiles and amphibians. A great many species have been photographed in black and white and we have now started to do the group in color. To date, in a period of six months, we have managed to obtain about 175 different reptiles and amphibians, all of which have been satisfactorily photographed on 35mm Kodachrome.

Equipment for photographing specimens in the laboratory includes the camera, tripod, illuminants, dimming unit, and the background. The choice of camera should be influenced by the results desired. Scientific photographs should have the extremely accurate focus obtainable with ground glass cameras. For exposing 5 x 7 inch monochromatic film we use the regular view camera with a seven and a half inch lens. For miniature work we use a 35mm camera with a sliding focussing attachment. Thus in every case we are absolutely sure our position of focus, coverage, depth of field, and the appearance of the animal. We use a sturdy, tilt and swing top tripod with adjustable legs, and a safety guard against upsetting. For lighting, a mixture of general illumination and spot lighting seems to bring out best detail in black and white negatives. Color film, of course, requires broad flat lighting. Those who are familiar with indoor type color film (Kodachrome A) know that it is

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EXPLANATION OF FIGURES

Figure 1. Bullfrog, *Rana catesbiana.* Photographs made in natural outdoor surroundings on 5 x 7 Panatomic film. Although this picture is an acceptable field photograph, many of the animal characteristics are obscured by the background.

Figure 2. Green Frog, *Rana clamitans.* Made from a 35mm Kodachrome transparency. The continuous white background and general illumination displays the actual animal characteristics much better than the field photograph above.

Figure 3. Wood Tortoise, *Clemmys insculpta.* From 35mm Kodachrome.

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corrected for photoflood light only, whereas black and white film does not have this distinction. If much work in live animal photography is to be done, a light dimming unit is almost essential. With such an instrument the lights may be dimmed while focussing, thus keeping excessive light and heat from the animals. A master switch can bring all the lights up to full brilliance with a single motion and thus eliminate individual lamp switching. The sudden increase of light from dim to its full brilliance, as necessary for exposure, sometimes has the effect of temporarily startling the animal and causing it to hold a pose for several seconds without movement. There are, however, many nocturnal animals which strenuously object to large amounts of light and these specimens are apt to dash away as soon as even the dim lights are turned on. Great amounts of patience are required when doing this type of animal. The equipment mentioned thus far has been found most satisfactory to date.

The choice of background may be influenced by several factors. Many laboratories, including ours, object to the use of similated natural backgrounds because the accuracy of the resulting photograph is lessened. The difficulty in obtaining surroundings which might represent natural habitat, as well as the possibility of obscuring animal detail, suggests that a plain background is best. For our purposes we have found that a plain, white, continuous, background is most satisfactory. We obtain this with a curved sheet of white cardboard or heavy chart cloth. The background can be set up, the lights generally arranged, and the camera placed approximately in position before introducing the animal into the picture area. Having arranged the apparatus, the next step of posing the animal will require the most skill and patience

The average requirement of reptile and amphibian photographs is that the specimen be naturally and gracefully arranged, fully alive and alert, and that it show well displayed characteristics. If the animal is normally vigorous it will doubtlessly desire to run or jump away. This is to be expected and must be followed by the constant replacing of the animal until it remains quiet long enough to allow focussing and exposing of the negative. It will be found that almost every animal requires a different technic to induce it to remain in position. I will list our experiences with frogs, salamanders, turtles, lizards, and snakes so that this information about each group may be of some assistance to others attempting similar work.

The frog group ranges from the big bullfrogs to the tiny adult tree frogs *Pseudacris ocularis* which are but ⅜ of an inch in length. In many cases long bellows extensions, short focal length lenses, and metal exten-

sion tubes (for 35mm camera) will be necessary. If only one view is to be taken, a 30 degree angle perspective, (approximately) places the camera in an acceptable position. We have found that a sheet of cold white opal glass placed beneath the frog is the best method of preventing restlessness. Frogs do not like to be dry and thus we constantly remove them from the glass, place them in cool water, and then put them back on the opal glass. This may, as indicated, have to be repeated many times, though occasionally a specimen will remain perfectly still the first time. For making last minute manipulations of the animals head and feet, we find that a piece of bent wire is preferable to actual handling. If the water in which the frog is moistened is quite cold it is apt to induce sluggishness. It should be noted, however, that for many specimens excessive cold causes a noticeable darkening of the animal colors. This should be avoided where ever possible. Due to the small size of frogs it will be found difficult to secure sufficient depth of field with reasonable shutter speeds. Those who are familiar with the properties of lenses know that the depth of field is greatest on the far side of the point focussed upon. Thus if the open diaphragm is at about 1/3 of the distance to be covered, the diaphragm may then be reduced until all the animal is sharply in focus. This will represent a minimum aperture. In a great many cases we have found that the animal's eye provides the best point for open diaphragm focussing. Exposure is, of course, dependent upon lighting conditions, film speeds, and diaphragm openings. Our usual exposures for taking pictures as described in this paper are, for monochromatic film, — ½ second at f 22, and for color film, — 1/20th second at f 8. The light dimming unit is quite effective with frogs. The dim position prevents rapid drying of the frog and the brilliant lights provide a "shock" when turned on. The animal may thus be so startled as to remain motionless. It also may be startled into movement and jump away. One of our frequent difficulties with frogs is that they have a tendency to jump away and land in one of the hot reflectors.

Salamanders are also in the small size range and for photography they too require long bellows and tube extensions on the camera. We have employed several technics in our attempts to get good pictures of

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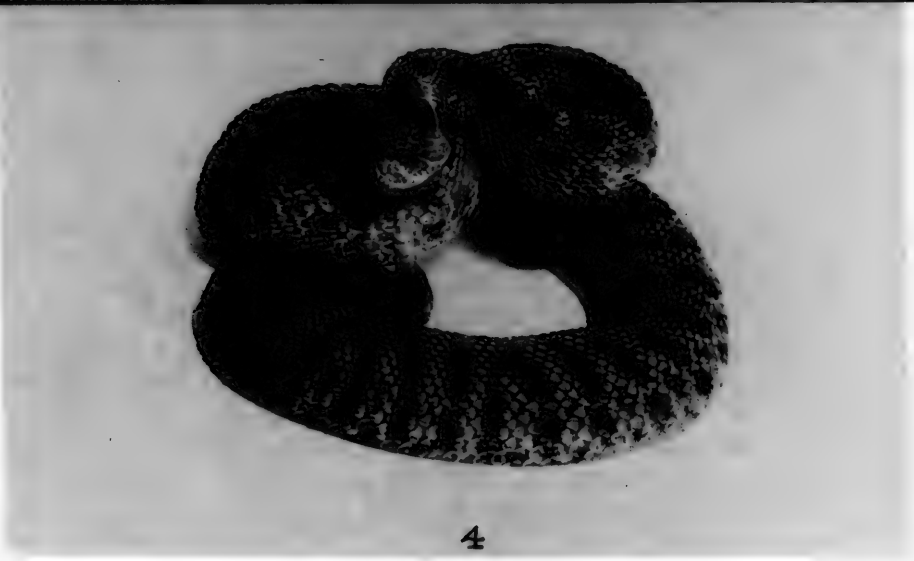
EXPLANATION OF FIGURES

Figure 4. Great Plains Rattlesnake, *Crotalus viridis viridis.* This illustration would have been much better had a side view of the head been shown and the head outlined against the background. From 35mm Kodachrome.

Figure 5. Leopard Lizard, *Crotaphytus wislizenii.* From 35mm Kodachrome.

Figure 6. Red Racer, *Cluber flagellum frenatus.* From 35mm Kodachrome.



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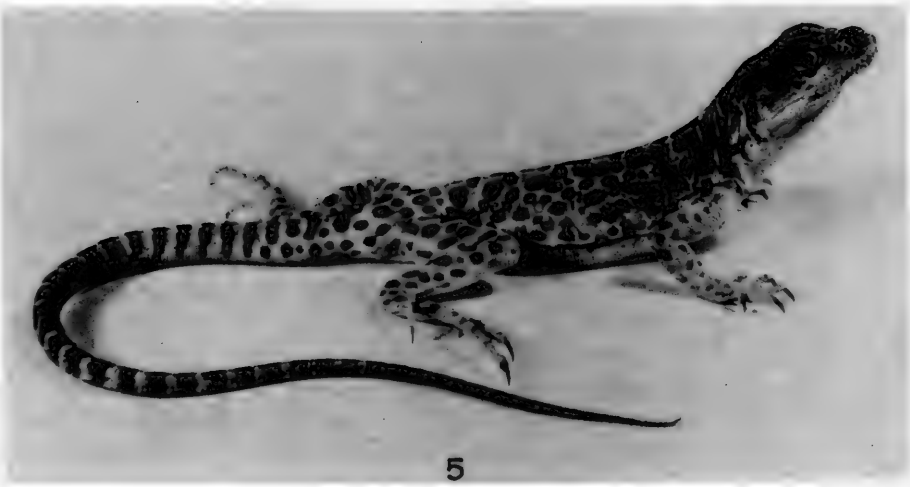

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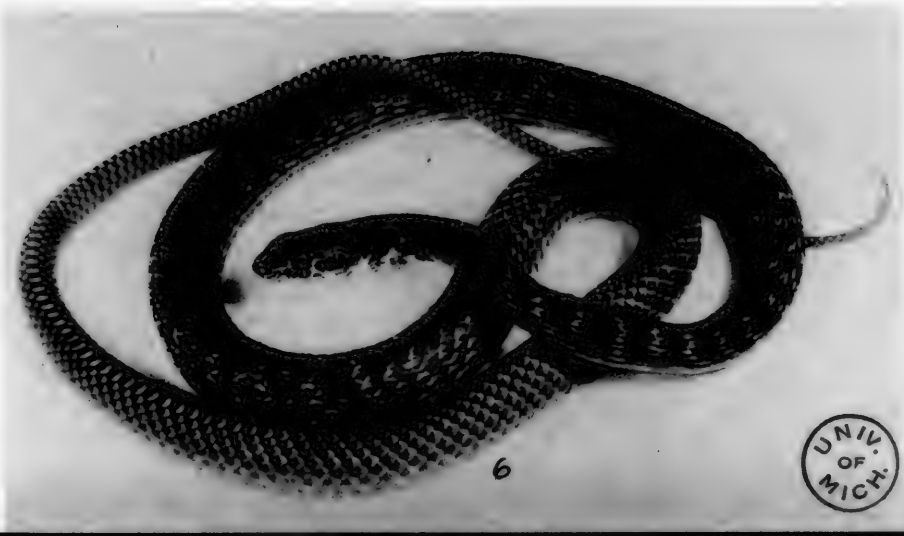

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salamanders. Photographs of these amphibians on hot dry cardboard are usually unsatisfactory as the specimen sticks to the surface and does not move gracefully into position. Salamanders, like frogs, must be kept moist or else their skin gets dry and wrinkled instead of retaining its normal smooth glossiness. We have tried wet white cotton as a background and found that the animal poses well on it, though the fiber detail of the cotton background is sometimes objectionable. The cold opal glass and constant wetting technic has been our most satisfactory method to date. We have attempted several salamander pictures when the animal was submerged in a glass cell filled with water. The background in the cell consisted of a curved sheet of white cardboard placed in the water. The animal is rather difficult to pose in water, though it can be manipulated somewhat with a glass rod. Light reflections from the cell wall must be avoided and the cell must be perfectly clean. When photographing salamanders without a cell, care must be taken to avoid bad highlights reflecting from the uneven surface of the animal's body.

Turtles have proven the most difficult of the herpetological group to photograph, in our experience. Their tendency to withdraw head, feet, and tail into their shell and sometimes wait for long periods before emerging, requires a maximum of patience by the photographer. After having made the decision to come out of their shells, the turtle may immediately try to crawl away, and if stopped, may retire once more into its shell. This timidness, coupled with the fact that many of the color markings can only be seen when the head is fully protruded, makes these animals the most difficult of any group to photograph. Upon one occasion we posed and re-posed a turtle for an hour and a half without obtaining a single exposure. However, we eventually got several good pictures. The width of the shell in many turtles requires additional depth of field. We have found that most turtles can be made quite active by switching the full brilliance of the lamps upon them. If the animal's head and feet are allowed to become quite active while being held in place by its shell, it may sometimes, when quickly released, be photographed before the animal decides to crawl away. There are, of course, times when the turtle may pose nicely at once, though this is extremely rare.

Lizards have proven to be the easiest to photograph. A large majority of them, particularly desert forms, are content to bask in the warmth of the flood lights without moving. Very often they even relax and close their eyes. They can be brought to attention and alertness by tapping on the background near them. Due to their long narrow body and tail, most of the animals can be brought into focus with a fairly large size diaphragm opening. Some of the lizards with very long tails

utilize such a small portion of the actual film area that it is acceptable to curl their tails in such a manner as to obtain a larger image. Contrary to the average species of this group, there are some nocturnal lizards which are extremely difficult to photograph under brilliant flood lighting. Focussing is accomplished with a minimum of light after which the full brilliance of the illumination is switched on.

Snakes require the greatest variation in technic of any group mentioned. Their great range of size and temperament makes them the most interesting group to work with. Obviously the long narrow body and tail of the snake does not fit well into standard film areas. It is quite acceptable to coil the snake in such a manner that it fills the field as long as the distinguishing characters of the snake are visible. The depth of field necessary to include all of a coiled snake is so great that it often requires a high camera perspective. Open diaphragm focussing should be done with care to insure greatest utility of depth of field. The position of the animal is regulated by its activity and willingness to assume an acceptable pose. Many snakes thrash wildly about when placed on the background. Others move slowly but incessantly. Some pose at once. The majority of snakes will pose best under the dim lights and are subsequently startled into stillness for several seconds by the brilliant full illumination. Experience in handling snakes is almost essential to individuals trying to pose them. In all of our work with reptiles and amphibians there are at least two of us working together. One person does the posing and the other the photographic work. Strangely enough we have found that the large vicious animals are apt to be the easiest to photograph. Special emphasis is necessarily given to the suggestion that only experienced handlers be allowed to manipulate and pose poisonous and vicious snakes. When handled properly, excellent photographs of rattlers, copperheads, water moccasins, coral snakes and others can be made. We have found that a rattlesnake placed on the background quickly assumes a striking position and will remain motionless unless disturbed. The deadly little coral snake was one of our most difficult subjects to photograph as it insisted on moving constantly. Snake sticks should be used for handling the snakes wherever possible. A good method of calming snakes is to place a heavy cardboard box over them while on the background, turn off the lights, and wait several minutes before removing the box. The box should be about the same size as the desired snake area and may be generally focussed upon before its removal. On one occasion when photographing a restless snake we could not find a suitable box, so we placed a felt hat over the animal. After turning out the lights and patiently waiting ten minutes for the animal to settle

down, we focussed the camera on the hat area, turned on the dim lights, and lifted the hat. Much to our surprise we found no snake. Convinced that the snake had either escaped or that we had discovered a genuine trick in magic, we began a search. After hunting a while we finally found him—inside the lining of the hat!

There is a great deal of pleasure to be had in making pictures of live reptiles and amphibians, both in the laboratory and in the field. There have been a great many times when our patience has been severely tried by the perverse nature of some of the beasts, but we can say with great satisfaction that we have never resorted to such practices as etherizing or the photographing of dead or preserved specimens and misrepresenting them. We have photographed a great number of animals and, to date, have encountered none of which we could not eventually get a "live" picture.

Film processing follows standard practices. Five by seven inch cut film is developed in DK-50. An attempt is made to secure negatives which can be printed on a No. 1 or No. 2 paper. Kodachrome A is used for color transparencies and is, of course, processed by the Eastman Kodak Company. All slides and negatives are filed numerically. Written records of the name of the animal, date, collector, collection locality, and technical exposure data are made for each animal. This information is placed on 3x5 cards and filed both numerically and in the classified order of animal grouping.

The methods suggested in this paper undoubtedly represent a small number of the possible technics and experiences with live animal photography. They will, however, serve as a slight addition to the large amount of material which has been written on the subject of biological photography.

Although I make all the photographic manipulations when working with animals, the majority of credit for the work is due to Mr. Robert McCauley and Mr. Harold Trapido, both of this laboratory, for their efforts in securing, handling, and posing the specimens.

INCANDESCENT LAMP CHARACTERISTICS FROM THE PHOTOGRAPHER'S VIEWPOINT

ROGER S. ESTEY*

THE incandescent lamp is so common and ordinary that a discussion of its characteristics seems superfluous. Yet a moment's reflection will show that this light source is basic and fundamental to the development and success of photography as a profession. For many casual purposes it is possible to accept the incandescent lamp without comment or study, but for the specialized applications which are so important in photography, a knowledge of incandescent lamp characteristics becomes valuable.

DISTRIBUTION OF ENERGY IN A LAMP

A 100-watt lamp (taken as typical) is so proportioned as to use exactly 100 watts of electrical energy. The lamp converts all of this electrical energy into other forms of energy. In order to operate the lamp efficiently the manufacturer must minimize all contacts between the filament, its supports and the lamp base. The gas filling is necessary to blanket the filament and prevent too rapid evaporation of the tungsten, but the convection currents in this gas dissipate so much heat that the lamp manufacturer has been forced to develop more efficient filament shapes. The squirrel-cage vacuum lamp was superseded by the coiled filament gas-filled lamp. Subsequent development produced the coil-coiled filament permitting a more compact light source and one conducting less energy to the gas.

Twenty-seven and one-half per cent of the watts supplied to a 100-watt lamp is lost by the various forms of conduction and convection just described. The remaining 72.5 per cent (or 72.5 watts in this case) heats the filament and is emitted from the heated filament in the form of radiation. Most of this radiation is transmitted through the glass bulb. Convection currents in the gas and the small amount of radiation absorbed by the bulb account for the high bulb temperature. Only a small portion of the radiated energy (8.5 watts) is of a character suitable for use in seeing and but little more is of use in photography. The distribution of the energy from a 100-watt lamp is summarized in figure 1.

RADIANT ENERGY

The electrical energy supplied to the lamp is transformed into temperature radiation which is of the well-known black-body type and has

* Received for publication April 29, 1940. Spencer Lens Company, Buffalo, N. Y.

very interesting properties. Temperature radiation is emitted by all heated surfaces in a manner characteristic only of the surface and of the temperature. By studying the radiation from a heated enclosure such as a

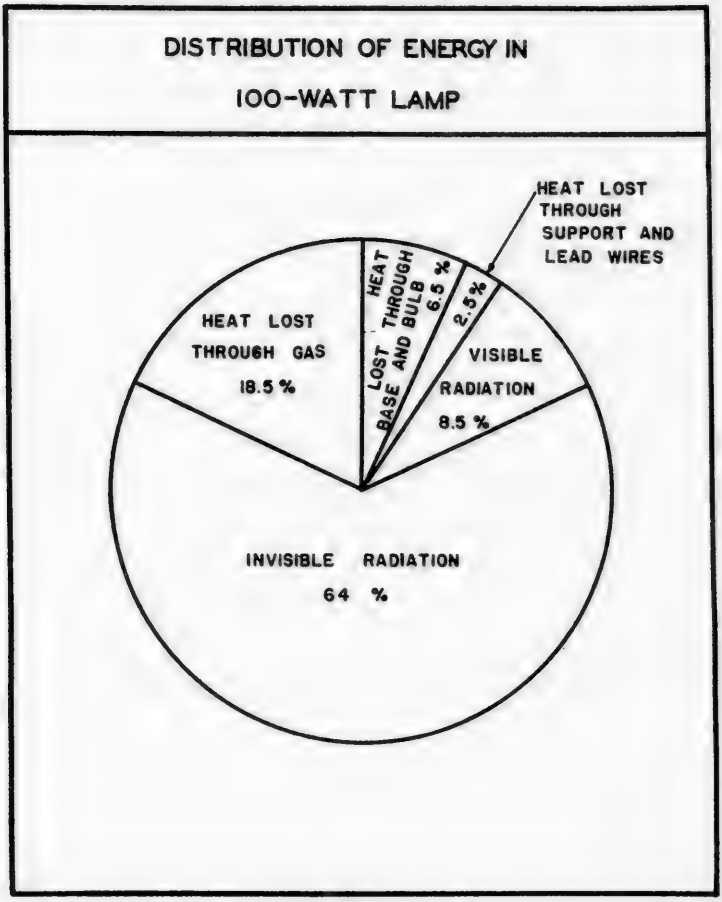
DISTRIBUTION OF ENERGY IN
100-WATT LAMP
HEAT LOST THROUGH SUPPORT AND LEAD WIRES
2.5%
HEAT LOST THROUGH BASE AND BULB 6.5 %
HEAT LOST THROUGH GAS 18.5 %
VISIBLE RADIATION 8.5 %
INVISIBLE RADIATION 64 %

FIGURE 1

furnace, the surface effect can be eliminated. In such a case the radiation is completely defined by the area of the furnace-opening which emits the radiation and by the temperature of the furnace. At low temperatures (about 900 F) the furnace shows an incipient red glow which as the temperature rises passes through the familiar furnace colors of red, orange and yellow to white. A rapid increase in brightness is also noticeable. The light from a tungsten lamp behaves similarly. As the voltage applied to a lamp is raised from very low values the filament

temperature increases, the lamp begins to glow with a light which with increasing voltage rapidly becomes both whiter and brighter.

The proportion of energy radiated at various wave lengths is shown by the designated curve in figure 2. Notice that only a trifling amount of energy is emitted in the ultra-violet (wave lengths shorter than 400

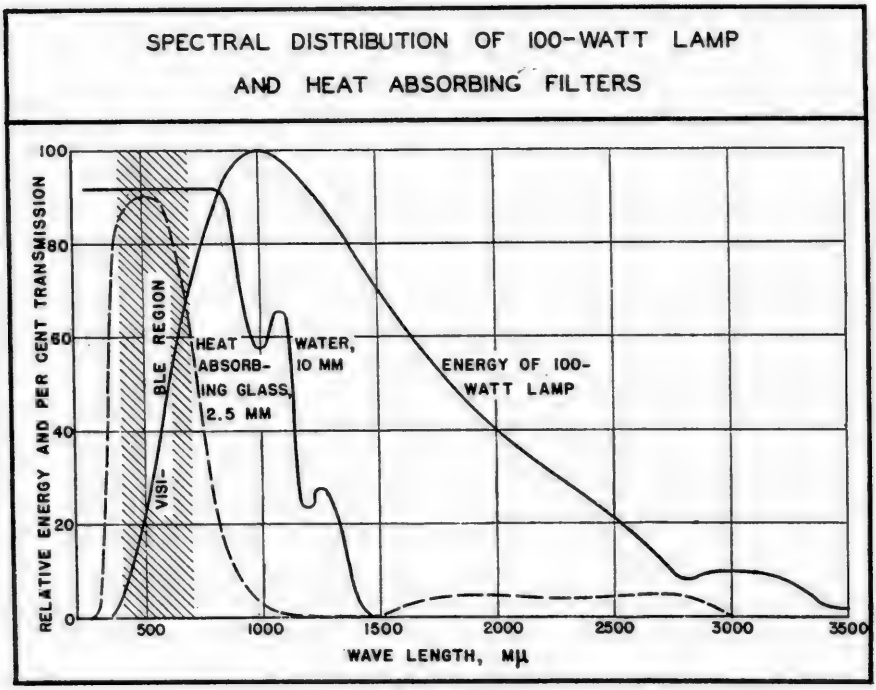

FIGURE 2

microns. In the visible region (between 400 microns and 700 microns) the energy radiated is still small but increases rapidly with wave length[1].

[1] This is a good place to digress on the differences between radiation and light. Energy in radiant form is the most general concept. It has characteristics of both wave length and intensity. In the case of our example, the 100-watt lamp, the wave length limits are approximately 300 microns and 3500 microns respectively. These various rays have properties which in part are characteristic of the wave length. The ultra-violet rays, 300 microns to 400 microns produce certain photo-chemical effects. The retina of the eye responds to rays between 400 microns and 700 microns. The photographic emulsion is responsive to the band of tungsten lamp radiation between 300 microns and 1100 microns. The rays of longer wave length than this have no specific effect but all radiations of whatever wave length act to heat any any surface on which they are absorbed. This heating is proportional to the amount of energy absorbed. We call the radiation emitted between 400 microns and 700 microns "Visible Radiation" when the physical character is to be emphasized. Such radiation is measured in physical units. On the other hand, "Light" is defined as the psychological response of the human eye to radiation. The magnitude of the response varies with wave length, being a maximum at about 555 microns. Light is measured in a psychological unit, the candle. In relatively few cases is it necessary to make careful distinctions between these terms and in ordinary conversation the word "light" may be used to mean either "radiation" or "visible radiation." Sometimes more exact interpretations are necessary as, for example, in the captions of figure 1 and in the discussion of heat absorbing glass which follows below.

The maximum energy is emittd in the near infra-red region. The transmission of the glass bulb is practically non-selective within the regions mentioned but shows selective absorption in the infra-red beyond about 2400 microns as shown by irregularities in this part of the energy curve. The curve illustrates the characteristics of a typical 100-watt lamp. Lamps which operate at lower filament temperatures would show a maximum intensity further in the infra-red and a relatively lower intensity at the blue end of the spectrum. Higher filament temperatures, such as are used in photo-flood lamps, shift the energy maximum toward shorter wave lengths and rapidly increase the filament brightness.

It was stated earlier that the character of the radiation depended on the surface as well as the temperature. Obviously the use of filters or colored reflecting surfaces will also modify the character of the radiation, within the visible spectrum at least. The light from incandescent and from some other sources can be described in terms of temperatures more or less different from the true temperature of the source. In all discussion of temperatures in connection with radiation, the Kelvin temperature scale is the most fundamental and is the one commonly used. On the Kelvin scale the intervals are the same as on the Centigrade scale but 0° Kelvin is — 273° Centigrade. The "brightness temperature" of a lamp is the true temperature of a black-body which matches the lamp in brightness. Brightness temperatures are used in optical pyrometry.

Color Temperature

From the viewpoint of the photographer the most useful concept is that of color temperature. The "color temperature" of any incandescent light source, or of any other light source of suitable color, is the true temperature of a black-body which matches the light source in color. Under many circumstances the color temperature bears no evident relation to the true temperature of the source. The sun and moon, for example, both have a color temperature of about 5000 K and the color temperature of the bluer parts of the sky may reach 50,000 K. The lack of correlation with the true temperatures of these sources is obvious. In the particular case of the filament in a tungsten lamp the relation between the color temperature of the light and the true temperature of the filament itself has been measured and is shown in table I.

TABLE I
COLOR TEMPERATURE OF TUNGSTEN
(Forsythe and Worthing, 1924)

True Temp., K	*Color Temp., K*
1000	1006
1400	1414
1800	1825
2200	2242
2600	2663
3000	3094
3200	3311
3400	3533
3655*	3817

*Melting Point

The color temperature of a variety of illuminants including several of particular interest to photographers is shown in table II.

TABLE II
COLOR TEMPERATURE OF VARIOUS ILLUMINANTS
(Different Authorities)

Source	*Color Temp., K*
Noon sun	5000
Carbon arc	3780
Photoflash lamp	3500
Tungsten arc	3550
Photoflood lamps	3410—3490
Gas-filled tungsten lamps	2670—3300
Vacuum tungsten lamps	2390—2500
Kerosene lamp	2055
Sperm candle	1930

At the present time the manufacturers do not commonly list the color temperatures at which their lamps operate, but they do list the efficiencies. Approximate color temperatures can be obtained from the published lamp efficiencies (lumens per watt) by means of the graph, figure 3.

For the sake of uniformity, typical values for three common illuminants have been standardized by the International Commission on Illumination. These color temperatures are listed below.

TABLE III
COLOR TEMPERATURE OF I. C. I. ILLUMINANTS

A	Typical of tungsten light	2848 K
B	Typical of sunlight	4800 K
C	Typical of daylight	6500 K

Color temperature is ordinarily measured in one of two ways. The common photo-cell method compares the brightness of selected bands of blue and red rays from the source. The red-blue ratio as measured on

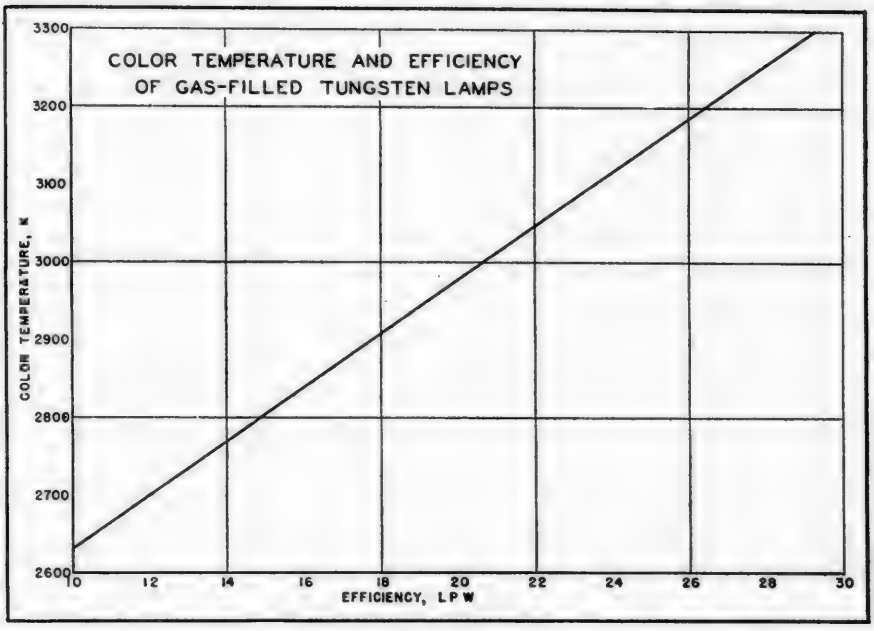

FIGURE 3

the instrument can be interpreted in terms of color temperature if the instrument is first calibrated with the aid of color temperature standards. The visual method uses a split-field photometer to compare the color of the unknown source with that of a color temperature standard. Any difference in brightness is equalized by a suitable adjustment of the photometer. With practice an observer can read color temperature to within two or three degrees at 2848 K.

VOLTAGE VARIATION

If the voltage applied to the lamp is varied, the current, watts, filament and color temperatures, light output, and lamp life will also vary. These have been carefully studied by lamp manufacturers and photometric laboratories and quite exact data correlating these lamp characteristics have been published. Unfortunately, the exact relationships vary somewhat with lamp size and design and with the amount

by which the voltage is varied from its rated value. For moderate variations from rated volts and for gas-filled lamps the relationships given below are approximately true.

TABLE IV
EFFECT OF VOLTAGE VARIATION

1 per cent increase in volts	=	0.6 per cent increase in amperes
	=	1.6 per cent increase in watts
	=	3.5 per cent increase in light
	=	13.5 per cent decrease in life

The large variation of life with voltage shows why lamps sometimes have a surprisingly short life. The line voltage in most localities will be maintained between 115 and 120 volts but a few places show a wider spread of line voltage. Although the service mains may deliver the correct voltage, line drop in the laboratory wiring adds another uncertain factor. In the last analysis the only solution to early burn-out trouble is to measure the voltage right at the lamp and either obtain lamps to suit or else make minor voltage adjustments with a transformer or rheostat.

The 3.5 per cent gain in light shown in the above table is sometimes worth working for, but one must remember that it is obtained at the expense of a 13.5 per cent loss in life. It may be remarked that although short life is very noticeable, lamps are relatively cheap and for special purposes lamps may be intentionally overloaded for short periods. The photoflood lamp, for example, is designed to be so used.

LAMP DESIGN

The common lamps used in the factory, office and home are made in millions by automatic machinery. They are effective, of uniform quality and cheap. These and certain special lamps (projection lamps, for example) are listed in the manufacturer's catalog. A group of lamps of very limited demand is classed as special and is not cataloged but may be obtained from the manufacturer when required to serve particular applications.

In the design of lamps the bulb size must increase with the wattage to avoid bulb temperatures which would soften the glass and to avoid excessive blackening. In certain cases the bulb size required may be reduced by air blast cooling or the filament-to-wall distance reduced by cylindrical bulbs or offset filament mounting. (The latter is very special.) One must assume that it is not practical to force many more watts into a given bulb size than is represented by present practice.

For various reasons lamps with thick filaments can be made to be more efficient. They give more and whiter light. Their life is more satisfactory. The filament position can be more accurately maintained. Of course large filaments require large currents—which to avoid excessive wattages indicate low voltage designs which require transformers or rheostats for adaptation to conventional circuits. In view of this, it is more satisfactory, where possible, to use the small wattage 115-volt lamps in spite of the limitations imposed by the hair-like filaments which these lamps contain. The possibilities of massive filament construction in achieving high brightness are shown in the table.

TABLE V
BRIGHTNESS OF SELECTED LIGHT SOURCES

Source	Current, amps.*	Brightness, candles/mm^2
Vacuum tungsten	0.36	2.1
Gas-filled tungsten	1.0	3.8
Gas-filled tungsten	10.0	20.6
Ribbon filament	18	20
Pointolite		10
Carbon arc, neutral core		150—180
Carbon arc, high intensity		300—800
Mercury arc, water cooled		300
Sun, zenith		920—950

* The magnitude of the current suggests the massiveness of the electrodes.

Tungsten used for filaments is in the form of a drawn wire having considerable ductility and tensile strength. After being in a lamp for some time at incandescent temperatures the heat re-crystallizes the tungsten in such a manner that the filament becomes increasingly brittle and slippage between the crystal planes may permit the filament to sag. Two practical applications of these facts may be noted. Throughout the life of a lamp its fragility and likelihood of damage from transportation increases. A new lamp filament is surprisingly tough and can withstand a great deal of rough handling. During the early hours of life the light output increases noticeably due to the initial crystallization. Subsequently, as the filament evaporates, a brown coating deposits on the bulb wall. Although most of the deposit collects at the top of the bulb, the light output and color temperature slowly decrease.

COLOR FILTERS

For various purposes tungsten light may be modified by color filters. The possibilities are too varied to justify more than a couple of

examples to illustrate the general principles. In every case the filter can only modify the light by absorption. The filtered light is always less intense than that originally supplied.

Photographers are particularly interested in three color temperatures; 3200 K for use with Kodachrome B, 3400 K for use with Koda-

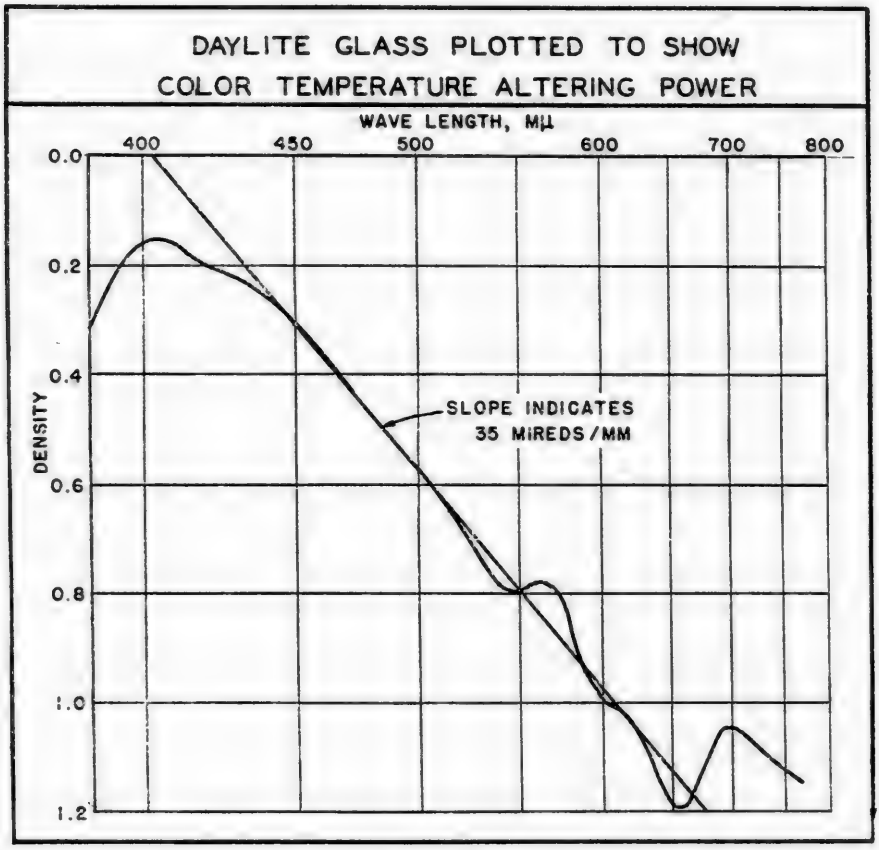

FIGURE 4

chrome A, and 5000 K which photographic standardizing laboratories consider to be representative of daylight. These color temperatures can be obtained with the aid of bluish filters used to modify the light from tungsten lamps operating at lower temperatures than those just mentioned. Bluish filters whose light transmission varies with wave length in such a manner that the filter density at each wave length plots as a straight line against the reciprocal of the wave length, are good color

temperature raising filters. The increase in color temperature caused by a given filter depends both on the color density of the filter and on the initial color temperature. On a reciprocal scale of color temperature, however, the color temperature increase is independent of the color temperature of the source. Filters can be calibrated on this basis. Furthermore, in the case of homogeneous filters, the color temperature altering power is proportional to the thickness. This reciprocal scale is so convenient that a unit called micro-reciprocal-degree (mired for short) has been established. To convert from degrees K to mireds, divide the color temperature by a million and take the reciprocal of the result. Corning Daylite glass, for which the spectro-photometric data plotted as described above are shown in figure 4, has a calibration of approximately 35 mireds per mm. The calculation of the filter thicknesses necessary for three typical color temperature conversions is shown below.

TABLE VI
THICKNESS CALCULATION FOR COLOR TEMPERATURE RAISING FILTERS

100-watt lamp, initial color temp. 2740 K, 365 mireds
Desired color temp. 3200 K, 312.5 mireds
Color temperature difference 52.5 mireds
Thickness of Corning Daylite glass 52.5/35=1.5 mm

100-watt lamp, initial color temp. 2740 K, 365 mireds
Desired color temp. 3400 K, 294.1 mireds
Color temperature difference 70.9 mireds
Thickness of Corning Daylite glass 70.9/34=2.0 mm

100-watt lamp, initial color temp. 2740 K, 365 mireds
Desired color temp. 5000 K, 200 mireds
Color temperature difference 165 mireds
Thickness of Corning Daylite glass 165/35=4.7 mm

Light of daylight quality results from the mixture in natural proportions of sunlight and skylight. It is intermediate in color between these. All wave lengths of visible light are represented in approximately equal proportions. As is shown in figure 5, tungsten light is relatively deficient in violet and blue rays and has a superabundance of yellow, orange and red rays. Correction to daylight quality can be obtained by the use of a special bluish filter having an absorption carefully graded throughout the visible region to produce the proper distribution of energy. In addition to the blue glass described above, Wratten gelatine filters are also available for this purpose. The distribution of energy from a tungsten lamp as modified by the Daylite filter and the transmission

of the filter itself are also shown in the figure. After the tungsten light passes through the filter its energy distribution, which formerly was de-

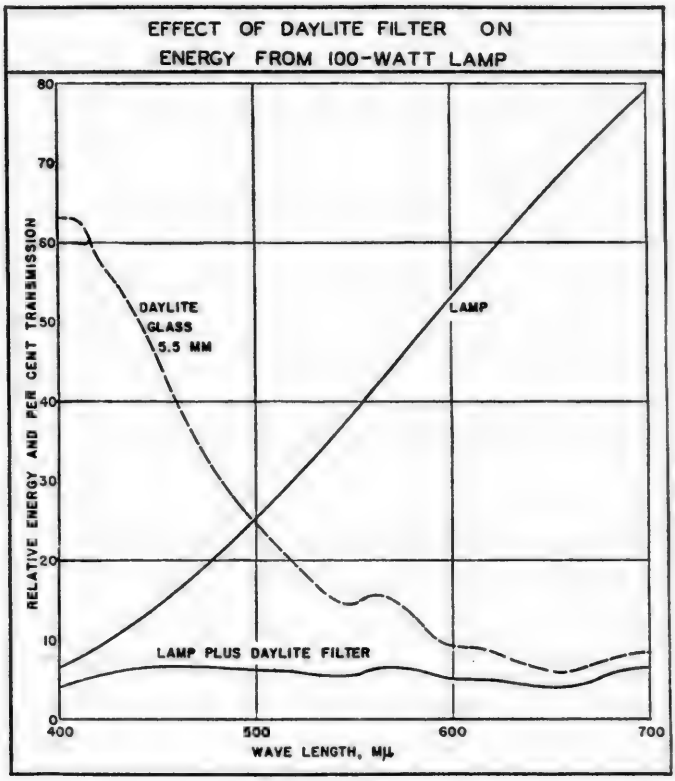

FIGURE 5

ficient at the violet and strong at the red end of the spectrum, is now made nearly the same at all wave lengths but its intensity is greatly reduced.

Another very common filter application is related to the absorption of radiant heat. Figure 1 states that the visible radiation from a 100-watt lamp amounts to only 8.5 per cent. This is consistent with figure 2 where the area under the part of the energy curve bounded by 400 and 700 microns, the limits of the visible spectrum, is only a small fraction of the area under the whole curve. The area under the whole curve is proportional to the heat content of the beam. Note that within the visible region the energy gives rise to both light and heat. One cannot be eliminated without the other. The ideal heat absorbing filter would be

completely transparent between 400 and 700 microns and completely opaque at all other wave lengths. In practice the region at wave lengths shorter than 400 microns can be ignored because of its small energy content. The longer wave length region is readily absorbed by 1 cm of water. The transmission of this thickness of water is also shown in figure 2. Water is quite effective as an absorbent but has many inconveniences. The region between 700 and 1400 microns can be absorbed by adding copper chloride to the water. As a matter of convenience it is more satisfactory to incorporate the heat absorbing material in a glass. The transmission of a heat absorbing glass filter is shown in the figure. The weak transmission band observable between 1600 and 3000 microns is of little consequence and can be absorbed by a water layer if required. The heat absorbed by heat absorbing glass is not destroyed but is expended in heating the filter. Precautions must be taken to keep the filter as cool as possible in order to avoid cracking the glass or causing other damage.

This short account of incandescent lamps and filters is designed to make the photographer better acquainted with some of the principal tools of his profession and to increase his confidence in their use.

MILWAUKEE

. . . is an interesting city and a beautiful city . . . nestled resplendently in a great harbor of Lake Michigan. Its reputation for hospitality has been unquestioned for many years. Enjoy this great city . . . its many places of interest . . . its attractions while attending the convention of the Biological Photographic Association at the Schroeder Hotel, September 12, 13, 14. The Milwaukee Chamber of Commerce has scheduled 334 conventions for the year 1940 with an expected attendance of 101,736. Of these 66 are National.

BOOK REVIEW

THE ACL MOVIE BOOK, *A Guide to Making Better Movies, by a group of the Amateur Cinema League, New York, Amateur Cinema League, Inc.*, 312 *pages*, 5¼ *by* 8 *inches, many illustrations, sketches and diagrams, issued free to members of the Amateur Cinema League, not for sale to others*

THE ACL MOVIE BOOK is not a book of detailed instruction on amateur movie making. It does, of course, discuss very briefly the considerations involved in selecting cameras, projectors and other movie making equipment; it broadly describes the various tools required and outlines their features and uses; but, much to the reader's advantage, it very carefully avoids repeating technical information which may be found in instruction books that accompany each item of new equipment.

From cover to cover this publication stresses the point that in order to be interesting and entertaining a movie must tell a story—not a long elaborately planned production, but some sequence, told in a series of related pictures. The pictures should be taken in line with some plan, and then with this story idea in mind, the film should be edited and titled to complete the story idea.

The authors realize that most amateur filming is of a personal nature, and that after taking the first few rolls of film the amateur may be confronted with the problem of "What to take." To solve this problem and to aid the amateur in obtaining more satisfactory results, the authors have illustrated the simplicity of creating and carrying out the story idea, regardless of whether it deals with baby's bath, a family picnic, a vacation trip, or a planned scenario.

Since the movie beginner is usually concerned only with camera technic and other problems encountered in taking "animated snapshots," he may be inclined to overlook the more important contents of the new ACL book. With additional experience, however, he cannot help but join with the advanced amateur in regarding the publication as a source of abundant ideas which will aid him in the completion of entertaining and interesting amateur movies.

Carl Hirth, Milwaukee.

CHATS WITH THE EDITOR

EX CATHEDRA*

WRITING

Scrutator in his notes recently had a few words to say about writing, and we heartily endorse one of his statements, namely: "It is a great pity more professional photographers do not write." It is more than a pity; it is a direct loss, first to themselves, next to their brother photographers, and lastly to the community they serve. As an encouragement to write, Scrutator gave some practical advice, and in some of the points he raised came near to providing the ideal basis upon which all good writing is founded. We were reminded of the advice given very many years ago to those about to speak in public: "Have something to say. Say it. Sit down." The real difficulty which many people encounter is that they have something to say but do not know how to say it, or alternatively are unable to put it down on paper. If you talk to them you discover that they have ideas, knowledge or experience well worth passing on, but find it difficult, if not impossible, to clothe their thought with words which will present the matter in logical form and with conviction. This disability is not confined to any particular section of the community. The power to use words is no prerogative of any one class. Many eminent scientific men find it very difficult to give a direct and convincing account of their work. This is sometimes due to their training. The scientific man is constantly seeking for the exceptions to his working hypothesis; it is second nature to him to guard against too broad a generalisation, and frequently this leads him to clutter up his exposition with reservations and explanations which confuse the main issue and have to be disentangled before his real message can emerge.

MODELS

If, then, this disability or malady affects all classes of the community, what can we do about it? Can we gain information and guidance

* Reprinted from The British Journal of Photography, 87:149-150, 1940.

that will enable us to conquer this lack of directness, this entanglement of ideas and general incoherence? We suggest that a careful study of a good daily paper can teach many valuable lessons. One of the first things the budding journalist learns is to prune his story of superfluous clauses; next to convert every indirect statement into a direct statement, to replace polysyllables into monosyllables, and finally to cut his 1,000-word article to a 200-word paragraph without losing sense or punch. That is no exaggeration, it is a drastic process carried out in hundreds of newspaper offices daily. After a time the habit of direct statement becomes established and requires no thought, the precise meaning of words and their correct use becomes part of the writer's experience, and the condensing of his narrative is performed mentally before pen touches paper. This is no Utopian dream, but a statement of fact that will be endorsed by any working journalist. Your daily paper can act as a model if you are prepared to study it and copy the methods used by men whose livelihood depends on their ability to write clearly, directly and convincingly. We are sincere in our desire that photographers, particularly young photographers, should write more than they do. Nor are our motives purely altruistic. We should like to see many more articles by men who know their subject and can write intelligently about it. We know how great a volume of valuable knowledge and experience is lost for lack of ability to communicate it to others and how grave a handicap the inability to express one's ideas can be in business and daily life. Because "writing maketh an exact man" we wish that all men could write. There would be less muddle and stupidity in the world today if every man could think clearly, and that is the first step to writing clearly. We hold no brief for Everyman, but we do hold a brief for photographers, and we ask them to give this writing business more thought than they have done so far.

APPLICATION

One of our gravest troubles to-day is that our educational system fails to educate. We have what we are pleased to call compulsory education, and when we receive its victims in our studios, offices or factories at the outset of their business career we have to commence their education in real earnest. That we placidly accept so ridiculous a state of affairs is due to our own incoherence, our inability to express what we think about it, and so gain the agreement of our fellows in a united protest that would compel the adoption of a saner and more practical system. Why should a boy or girl after spending

at least eight years at school be unable to write a letter, incapable of reading a few hundred words aloud without stumbling and stuttering, and find it impossible to clothe a few simple ideas with words? Is it any wonder that we want more people to write and to learn to think clearly? We have too much evidence of the handicap of ignorance and illiteracy to building up and maintaining a business. To us this incoherence and inability to express ideas is a real tragedy. We want articles grave or gay, practical or scientific, but that is merely incidental to the vastly greater need for more exact and felicitous self-expression. The man who can write a good article can write a good business letter. The latter will earn much more than the article. Nor is that all. We receive hundreds of letters in the course of a year asking for information or help in some large or small problem. Out of all these letters there are few indeed which clearly state the problem, and provide the necessary data upon which an adequate reply could be based. Result, further correspondence often involving disappointment on both sides. We actually have cases where the letters are so vague that we fail to discover their intention or their message, and we know, only too well, that our experience is a common one. Small wonder, then, that we echo and endorse Scrutator's lament: "It is a great pity more professional photographers do not write." Possibly we read more into it than Scrutator intended, but if that is so, we can only plead that we do so with the best interests of our fellow-photographers at heart. Our profession does not lack talented writers, but it wants many more of them; above all, it wants the art of writing cultivated as a direct and valuable business asset, so that as single units and as a united body we have the ability and the power to express our ideas so clearly and convincingly that no one shall misunderstand them.

CINEMATOGRAPHY OF SPIROCHETES

The problem of obtaining dark-field motion pictures of spirochetes has recently been attempted by two of our members, Mr. Paul Anderson in New York City, and Dr. Henry Roger in his laboratories at Sandy Hook, Conn. Mr. Anderson collaborated with Dr. Theodor Roseburg of the Department of Bacteriology, Columbia University. They have called their film "A Study of Spirochetes" and Mr. Anderson describes it as "darkfield motionphotomicrography of mouth spirochetes and associated motile bacteria, treponema pallida and leptospira biflexa. 300 feet, 16mm."

Dr. Roger made his film with Dr. John F. Mahoney, for the American Social Hygiene Association of the United States Public Health Service. Dr. Roger writes in a letter about his film . . . "there are no special problems involved except those of obtaining fresh and active material. In this laboratory it is quite a matter of routine to take micro motion pictures, especially with darkfield illumination which we employ whenever possible. Recently we have been especially successful with human and animal spermatozoae." Dr. Roger uses a 35mm. Standard Microcinema Apparatus, patented by him; and a 60 ampere high intensity arc-lamp, also of his own construction. According to Dr. Walter Clarke, Executive Director of the American Social Hygiene Association, Drs. Mahoney and Roger worked from morning until midnight preparing speciment after specimen. At midnight they did not know whether they had obtained any successful pictures. When Dr. Roger developed and printed the film they found they had about 60 feet of the living moving spirochetes. Dr. Clarke wrote: "It shows spirochetes in full motion — 'dead-white' spiral forms, twisting, turning, lashing, diving in and out of the depths of the specimen. One especially large and busy spirochete parades in the lower half of the picture as if he enjoys being conspicuous. This spirochete will doubtless be seen by hundreds of thousands of people as the leading criminal character in the new motion picture 'With These Weapons' produced by the American Social Hygiene Association."

CURRENT PHOTOGRAPHIC ABSTRACTS

Three Dimensions . . . In Color. J. A. Lucus. *Photo Technique*, 1:42-4, August, 1939. Any camera which uses Kodachrome can be used to take stereoscopic pictures provided a suitable tripod slide support is used to position the camera while each of the two required pictures is taken. For greater convenience, a 5-inch by 7-inch view camera can be adapted so that two lenses are used in the lens board, an opaque curtain separating the interior into two sections. With practice, stereoscopic pictures can be viewed without the aid of a stereoscope. C. J. K.

H6 1-40

Laboratory and Shop Notes: Labels for Photographic Records. M. L. Jackson. *Rev. Sci. Instruments*, 10:315, October, 1939. A blank for recording the data relating to the record is drawn on tracing cloth and contact printed onto a lantern slide. The slide is mounted in a printing box on one end of the record, the data being written on the form after processing. F. P.

L6

New . . . Heavy Duty Squeegee Plates. *Phot. Review*, 16:21, No. 2, October-November, 1939. The metal stock is covered first with a waterproofing bond to prevent peeling and rust. A clear hard enamel finish having a high polish is then applied. The edges are bonded to prevent chipping. It is claimed that this plate does not produce blister marks or mottled effects on ferrotyped prints. G. E. M.

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The Application of Electric Discharge Lamps to Photographic Processes. H. J. A. Turner. *Gen. Elec. Co. J.*, 10:93-105, May, 1939. The use of discharge lamps for practically all photographic processes requiring considerable artificial light yields advantages in economy, uniformity of illumination, convenience, and lower heating effects. High-pressure mercury lamps are recommended for printing, photo-copying, and photogravure; and fluorescent high-pressure mercury-vapor lamps for color work and portraiture. J. B. R.

256-K/44

Simple Aids for Processing Wash-Off Relief Film. W. G. Housekeeper. *Photo Technique*, 1:33, August, 1939. A washer intended for wash-off relief work consists of a copper tube perforated with small holes (No. 60 drill), spaced ⅛ inch apart. Either hot or cold filtered water is discharged from this tube and runs over the face of the film resting on an inclined tray. A tray-rocking device is described which permits smaller quantities of dye to be used in dyeing the matrices. C. J. K.

Photographer's Dermatitis and Its Treatment. U. F. Alstead. *Photography*, 7:23, July, 1939. The type of person predisposed to dermatitis is said to be one having dry, scaly skin, which is easily chapped in winter; having a tendency to asthma and hay fever; and in some cases having a nervous, emotional, or highly strung temperament. A fat deficiency in the diet may

also be involved and for this cod-liver oil is suggested as a remedy. Symptoms of dermatitis due to contact with metol are described, in both mild and severe forms. Appropriate lotions or ointments for the various stages of the affection are prescribed. For mild inflammation, the skin should be bathed with a solution of lead acetate (strong solution), 1 dram; liquor Carbonis Detergens, 1 dram; and calamine lotion to 4 oz. When the skin is broken and weeping, a lotion should be used consisting of: icthyol, ½ dram; liquor Carbonis Detergens, ½ dram; and calamine lotion, to 2 oz. When the skin reaches the later phase of tending to crust over, the following mixture should be applied: Lassars paste, 2 oz.; icthyol ointment, 1 oz.; hamamelidis ointment, 1 oz.; liquor Carbonis Detergens, 80 minims; and oil of cade, 20 minims. This mixture should be applied at night and in the morning and covered with a light bandage. T. L. J. B.

Progress in the Photographic Industry. A. Batley. *Ind. Chemist*, **15**:40-2, 77-8, January, February, 1939. Two articles give a review of the progress made during the last two years in photography, including the improvement of photographic materials and advances in their practical applications. G. W. W. S.

F1-019

Depth of Focus. F. P. Liesegang. *Phot. Ind.*, **37**:543-45, No. 18, May 3, 1939. Formulas are developed for the construction of two sets of curves from which the depth of focus of a lens may be read. The first set shows that the object distance is constant and that the other factors, i.e., the focal length of the lens, the f-value, and the diameter of the circle of confusion, are variable. In the second set, these factors are constant and the object distance varies. W. B.

02-05
2234

The Selectroslide. *Leica Photography*, **8**:11, 20, 26, June, 1939. The Selectroslide projection accessory consists of an adjustable timed motor, over whose shaft a 48-slide magazine is mounted. It may be used for automatic continuous projection and for remote manually controlled projection. The equipment takes 2-inch by 1-inch slides, after they have been inserted in special metal frames. G. E. M.

A New Method of Speed Determination. *Phot. Rev.*, **18**:16, December-January, 1939-40. A brief description is given of the new method of speed evaluation for Eastman films as worked out by the Kodak Research Laboratories. The values chosen are based on a gradient rather than a single density, and represent the minimum exposure which will produce a negative capable of giving an excellent print. The system was worked out after several years of practical testing during which many prints were judged by hundreds of people. G. E. M.

Scientific Data on Photographic Emulsions. *Phot. Rev.*, **18**:4-6, December-January, 1939-40. A brief description is given of the wedge spectrogram and how it is produced. Spectrograms to tungsten light are given for the six commonly used types of Kodak film. G. E. M.

Selected by permission of the Eastman Kodak Company from the Monthly Abstract Bulletin of the Kodak Research Laboratories.

NEWS FROM THE TRADE

News from E. Leitz, Inc., New York, N. Y.

New materials for making 2x2 inch slides: The making of two inch square glass slides from miniature color transparencies through the use of cover glass plates, masks and binding tape is such a simple matter that many photographers may have paid little attention to the quality or type of glass plates they were employing. However, they may have noticed that their final slides were not uniform in size and the edges were not neat. Upon examining the edges of the glass plates employed, it may have been found that instead of being flat there were slight protrusions formed when the glass was cut. The new Leitz Cover Glass Plates overcome these difficulties. They are uniform in size and thickness and in addition, the edges have been ground to provide an even, smooth finish. Slides made with the Leitz 2 inch square Glass Cover Plates will be uniform in size and have neat edges. Some photographers prefer to employ ready-made slide holders which permit small transparencies to be mounted with ease. Such individuals will be interested in the Leitz Automounts. These slide holders are composed of a metal frame, a cardboard mat, two small glass plates with ground glass edges, and a metal slider. To place a transparency in the Automount, the metal slider is merely lifted off, the film inserted between the two glass plates, and the slider again replaced. The latter has a cut-out portion which permits identification marks to be made on the cardboard mat. The Leitz Cover Glass Plates are packed 100 to the box and the Automounts are supplied in boxes of 18.

Leitz Shoulder Grip: A major nuisance and often a cause of expensive breakage to photographers is the tendency of the shoulder strap of the camera or carrying case to slip from the shoulder of the wearer. The shoulder strap problem has recently been solved with the introduction of the Leitz Shoulder Grip. This device is a flat, elliptically-shaped piece of material with a "toothed" rubber under-surface and with two pairs of transverse slits, that permit the shoulder strap to be inserted into it easily and firmly. When properly assembled, the Leitz Shoulder Grip becomes, in effect, a broad-surfaced, non-skid, "contact" segment of the strap. It keeps the strap on the shoulder, no matter how heavy the "load" carried, and is suitable for all types of carrying cases.

News from Agfa Ansco, Binghampton, N. Y.

New Edition of Formula Book: Photographers who carry out their own processing of sensitized materials will be interested in the new and

revised edition of the booklet—"Agfa Formulas for Photographic Use" — which has just been published. Including over forty-five formulas which have been developed primarily for use with Agfa Ansco materials, but which have general photographic application as well, the booklet lists formulas for developing, fixing, short-stop, toning, reducing, intensifying and desensitizing solutions. A separate section of the booklet gives a detailed description in simple language of the chemistry of development, and, in the current edition, presents new information on developer exhaustion and time-temperature compensation. The booklet is priced at ten cents per copy and is obtainable through photographic dealers.

Superpan Reversible Film ready for Agfa Memo Camera: In response to popular demand, a fifth film—Superpan Reversible, has been made available by Agfa Ansco for the 35mm. Agfa Memo Camera. This new Memo film is similar to that which has been supplied in 35mm. cartridges for Leica, Contax and other miniature cameras, and provides users of Memo Cameras with a fast, panchromatic *reversible* film that has many special applications. The developing service for the reversible films supplied at a cost of fifty cents per cartridge by seven authorized Agfa Ansco laboratories throughout the United States and Canada, eliminates the need for preparation of a separate film positive. In addition to its ample speed, panchromatic color sensitivity and brilliant gradation, Superpan Reversible film provides remarkably fine grain—a characteristic that has caused it to be selected in many instances where the final photograph was desired in greatly enlarged form.

Agfa 5x7″ View Camera available with 4x4″ back: In recognition of the demand for a professional camera to employ 4x5″ sheet films, a special model of the 5x7″ Agfa back, or, at the option of the purchaser, with both the regular 5x7″ back and a 4x5″ reducing back. This equipment brings to the critical worker the full versatility and flexibility of the regular Agfa 5x7″ model adapted to take the more economical and conveniently smaller 4x5″ film sizes. This new outfit includes the following mechanical features: Focal extension of 20 inches without use of detachable parts, 5¼-inch square lens board, tilting front with both rising and sliding adjustments, swinging back of wide adjustment, and the back of the camera permits use of a sliding groundglass attachment if split 5x7″ negatives are desired. This 5x7″ Universal View Camera with 4x5″ back is available through photographic dealers.

News from Bell & Howell Co., Chicago, Illinois

New Automatic Filmo Fader: One of the interesting features of the new Filmo Fader, manufactured by Bell & Howell, is an adjustable

arrow indicator, visible in the camera viewfinder, which shows when fades and wipes are completed. Thus, these professional effects for "dressing up" home movies are possible with the hand-held camera as well as with the camera on a tripod. The new fader, which is entirely automatic, fits all makes of 8 and 16 mm. cameras, and will make professional fadeins, fadeouts, wipe-ons, wipe-offs, and, when the camera is equipped to rewind the film, the transitional lap-dissolves. Furthermore, the fader can be mounted at any angle, so that wipes may be made to appear or disappear from any direction. The new accessory is a true fader in that fades are made with a rotating disc which is graduated from opaque black to a clear sector, and back again to opaqueness. Operation of the Filmo Fader is extremely simple. The mechanism is wound by moving the arrow through a single revolution. A light touch on the trigger releases the graduated fading disc which then rotates from opaque black to the clear sector, thus fading in the picture. Another touch, and the disc completes its revolution to fade out the scene. Wipe-ons and wipe-offs are made in the same manner by attaching the wipe disc, which is supplied with each fader. In both cases the operator sighting through the viewfinder sees the indicator move out of his vision when the trick transition is started, and back into sight again as the final fade or wipe is completed.

New Filmo "Auto Master" has 3-lens Turret: The new 16 mm. turret-head Filmo "Auto Master," first multi-lens magazine loader in the industry is announced by Bell & Howell. The "Auto Master" rounds out the line of single-lens Filmo "Auto Load" cameras announced a few weeks ago as successors to the well-known Film 141. It is powered by the 141 mechanism, but it is encased in a distinctive new housing designed in the modern mode. Important new features are: A rotating, three-lens turret, upon which any three lenses may be mounted—wide angle, speed, or telephoto. Any lens is instantly placed in photographing position simply by rotating the turret. Mounted directly on the turret beside each lens is the corresponding viewfinder objective As the camera lens is rotated to position, the matching objective is automatically seated before the viewfinder, offering a full-size image—no masking for telephotos. This is the same new type positive viewfinder as announced for the "Auto Load"—providing an image said to be 250% more brilliant than in previous models. A new, built-in exposure calculator which will give at a glance the correct lens setting for both Kodachrome and black and white film. Kodachrome figures are in red, those for monochrome in black. Additional features have been retained from the Filmo 141. The "Auto Master" operates at four speeds, 16-32-48-64 frames per second.

Built in are the single-frame release, starting button lock, and the "Spec-Tip" eyepiece for spectacle wearers. The footage dial is on the magazine, plainly visible through a window in the camera wall, and the entire Filmo family of lenses will fit the turret.

News from Photovolt Corp., New York, N. Y.

Small Spot Photometer: The new photometer is designed particularly for measuring low values of illumination on small areas as required, for instance, if a small spot of an unevenly illuminated surface is to be evaluated. The high-gain amplification makes it possible to use a rugged microammeter as the indicating instrument. The sensitivity of the Small-Spot Photometer is about 1000 times higher than the one of a conventional photometer using a barrier-layer cell directly connected to the same microammeter.

The new Photrix Small-Spot Photometer is claimed to be the first photo-electric instrument for taking light readings on small parts of the image on the baseboard of an enlarger. The extreme sensitivity of the new Photometer permits readings to be taken on areas as small as 1/32" diameter. On the basis of these spot measurements for selecting the most suitable grade of printing paper can be made reliably and without resorting to visual comparison methods. Complete photo-electric control of the enlarging process is made possible by the new instrument. The uniformity of distribution of the light on the baseboard, for instance, can be easily checked. The readings obtained with the Small-Spot Photometer, furthermore, permit controlling of the contrast by suitably adjusting the lens aperture or by changing the amount of diffusion in the optical system of the enlarger. If necessary, corrections can be made on the basis of the Photometer readings by spot printing and dodging. Electronic amplification is used in the Small-Spot Photometer to attain the high degree of sensitivity as required for the above type of measurements. The Photometer is a portable unit comprising the instrument proper and a flat search unit which houses the photo-tube. The meter needle indicates the light values directly on the instrument dial which carries additional scales for convenient reading of contrast and density. The Photometer operates on AC as well as on DC power lines and is fully balanced for line voltage variations.

A second model of the Small-Spot Photometer, designed for measuring transparent light, comes equipped with a search unit of tubular shape with a pointed light intake. This model lends itself for taking spot readings on the ground glass of cameras, making it possible to control light and exposure in a completely new and conclusive manner. In

photomicrography, measurements on the focusing screen of the micro-camera permit direct exposure determination even under light conditions and at magnification ratios calling for extremely long exposure time.

The Photometer with tubular search unit can also be used advantageously for exposure determination and selecting the proper grade of paper in contact printing. With the negative placed on a contact printer or on any other evenly illuminated transparent surface, the negative can be evaluated for density by scanning the highlights and shadows with the search unit of the instrument.

Gray scales of three color separation negatives can be easily measured directly on the negative. Or, else, these measurements can be taken on the projected image with the negative in the enlarger which makes it possible to evaluate gray scales of very small dimensions, even on separation negatives of miniature size.

The measurement of low light values on small areas, as made possible by the Small-Spot Photometer, permits the development of new methods in many fields other than photography. A few of these fields are:

Tyndall beam measurements in biological and chemical investigations.

Spectrophotometry.

Measurement of fluorescence, luminescence, ultra-violet and infra-red radiation.

Astronomical light measurements.

Further information can be furnished by Photovolt Corporation, 10 East 40th St., New York City.

News from Eastman Kodak Company, Rochester, N. Y.

New Precision Enlarger Units: Eastman Kodak Company, Rochester, announces a line of B Units for the Kodak Precision Enlarger designed to accommodate larger negatives up to 3¼ x 5½ and 4 x 5 inches. Major units are a Bellows Assembly B, and a Lamphouse Assembly B of the diffuse illumination type. The Stand Assembly A may be utilized with these B units. Introduced simultaneously are three new Kodak Projection Anastigmat Lenses, in focal lengths suitable for the larger negatives, and accessory equipment to be used with the major B units.

1940 CONVENTION

Plans and preparations for the "Tenth Anniversary Convention," are rapidly being completed. It will be held at the Schroeder Hotel, Milwaukee, Wisconsin, from September 12 to 14th inclusive. An outstanding scientific program has been arranged, which is not too crowded, yet contains presentations on biological photography which should interest everyone. We have digressed somewhat from the routine by including a little of the time available for entertainment, which will be educational as well. From all indications, the salon will constitute a very interesting feature of the convention. A round table breakfast has been arranged for Friday. We would urge the members to attend this breakfast as many subjects vital to all will be discussed. It will be necessary to make reservations for this round table breakfast.

We are happy to announce that Hon. Carl Zeidler, mayor of Milwaukee, will address the group on Thursday morning following the invocation by the Reverend A. G. Streich.

It will be our good fortune to be honored at the annual banquet by the presence of the Reverend Raphael C. McCarthy, S.J., President of Marquette University and author of the popular seller "Safeguarding Mental Health," at the annual banquet, who will have a message all of us should hear.

The tour through the Schlitz brewery is an added feature, which will be well worth your time. Supper will follow the tour and that well known Milwaukee hospitality will prevail.

Many of those attending the convention will do well to arrange to spend their vacations in Wisconsin, the garden spot of the United States and America's Dairyland.

For those motoring to Milwaukee, the FIFTH AND MICHIGAN GARAGE, a motoramp garage which adjoins the Schroeder Hotel to the south, will give a special parking rate as follows:

2 days — $1.50 3 days — $2.25

This includes the "Drive-in-and-out" privilege if paid in advance. Members and guests should drive direct to the garage and ask for CONVENTION RATES.

The convention committee is desirous of cooperating in every way with those expecting to attend the meetings.

LEO C. MASSOPUST,
Convention Chairman.

PROGRAM

THURSDAY, SEPTEMBER 12TH

9:00 A.M. Registration.
10:00 A.M. Invocation: Rev. A. G. Streich, Milwaukee, Wisconsin.
10:15 A.M. Address of Welcome: Hon. Carl F. Zeidler, Mayor of Milwaukee.
10:45 A.M. President's Address: Louis Schmidt, New York, N. Y.
2:00 P.M. Wayne M. Hull, M.S., M.D., F.S.C.P., Balyeat Clinic, Oklahoma City, Okla. *Endoscopic Photography.* Lantern slide presentation of endoscopic photography, Bronchoscope, thoroacoscope, cystocope, proctosigmoidoscope, and vaginal speculum.
2:45 P.M. Frank Scherschel, Milwaukee Journal staff, Milwaukee, Wis. *Stroboflash Photography.*
3:15 P.M. William Schanzenbach, Fleischmann Laboratories, New York, N.Y. *Time Lapse Photography in Industrial Research Work.*
4:00 P.M. Brewery tour, followed by supper in the "Schlitz Brown Bottle."
8:00 P.M. Projection Session.

FRIDAY, SEPTEMBER 13TH

8:30 A.M. Breakfast. Round Table.
9:30 A.M. John A. Maurer and James B. Glaze, Chicago, Ill. *An Integrated System of Copying.*
10:15 A.M. G. M. Busanovich, Germantown Hospital, Philadelphia, Pa. *The Copying of Roentgenograms.*
11:00 A.M. J. D. Brubaker, Evanston, Ill. *Proctosigmoidoscopic Cinematography with Kodachrome.* Discussion by Jay M. Garner, M.D.
1:30 P.M. Business Meeting.
3:00 P.M. Ferdinand Koch, M.D., Columbia Institute of Ophthalmology, Presbyterian Hospital, New York, N. Y. *Color Photography of the Human Ocular Fundus* — Its Technic with the Zeiss-Nordenson Retinal Camera. Slides will be used to demonstrate the technic of this specialized field of photography.
3:45 P.M. J. M. Gulas, D.D.S., Marquette School of Dentistry. Milwaukee, Wisconsin. *Advantages of Photography in Teaching Dentistry.*
4:30 P.M. Norbert Enzer, M.D., Mount Sinai Hospital, Milwaukee, Wis. *The Use of Kodachrome in Pneumoconiosis.*
7:30 P.M. Annual Banquet. Raphael C. McCarthy, S.J., President of Marquette University, Speaker and A. W. Proetz, M.D., St. Louis, Mo., Toastmaster.

(*Continued at bottom of page 44*)

ASSOCIATION NEWS

X-Ray Copy Competition

UNFORTUNATELY, owing to one of those errors that can occur in the best of work-shops, the competition X-Ray Film became way-laid in the middle west and lay under a pile of mail while more and more competitors applied for it. Though every effort has since been made to keep it moving, it cannot reach all those who asked for it before this year's Convention. If enough competitors have had it, the present competition will be judged at Milwaukee and another similar one will probably be started immediately afterwards, for next year. If only a few members have received it, the same film will be kept circulating and the judging will be postponed until 1941. In any event, the response has shown that many of our members like these trial subjects and want to photograph them, so in spite of all minor delays and discouragements, we will continue to hold competitions. Keep them moving!

Note for the benefit of readers whose subscription begins with this issue: The competition in question involves photographing a specific X-Ray film and obtaining from the copy negative one 5" x 7" glossy print and one 3¼" x 4" lantern slide. For further details write to the Chairman of the Competition, Mr. William Payne, State Institute for the Study of Malignant Disease, Buffalo, New York or to the Association's Secretary, Miss Anne Shiras, University Office, Magee Hospital, Pittsburgh, Pa.

The Boston Chapter

The Boston Chapter has the same habit as the Pittsburgh Chapter (who got it from the Philadelphia Chapter) of having a Dutch Treat Dinner before meetings. The good feature of Dutch Treats is that no one has a sense of obligation about them. Those who want to, come, and usually everyone ends by having a good time.

Saturday, September 14th

9:30 A.M. Election of Officers.

10:45 A.M. Adrian Ter Louw, Eastman Kodak Company, Rochester, N. Y.
Kodachrome as a Scientific Recording Medium.

11:30 A.M. Lloyd E. Varden, A.R.P.S., Agfa Ansco Corp., Binghampton, N. Y.
A Few New and Revised Photographic Procedures (Methods) for Possible Use in Biological Photography.

12:00 Noon A representative of Cameron Surgical Specialty Co., Chicago, Ill.
Simplified Color Photography for the Professional Man.

1:30 — 4:00 P.M. To be announced.

REGISTRATION FEE — $2.50
Guest Privileges — $1.00

The Boston meetings covered many subjects. They had movies that ranged from hurricanes to vocal cords, and speakers that talked on lighting, copywork, dental photography, fungus photography, homicide squads, and many other subjects. No plans for next year were included in their report but the Chapter seems to be well established, having been founded the season before the National Convention met there in 1936, and judging by its programs, is very much alive.

Portable Equipment for Color Photography

The March 1940 number of the "Archives of Dermatology and Syphilology" carries an interesting article on natural color photography of the skin by one of our members, Dr. Arthur E. Schiller of Detroit. It describes equipment for 35mm. color pictures requiring a minimum of space and adjustments. Two R-2 photoflood bulbs and a miniature camera are incorporated into a single piece of apparatus which can be held in the hand for short exposures or mounted on a tripod for longer ones. There is both an illustration and a description of this handy method of illuminating and photographing small areas. Each operator may wish to introduce modifications of his own, but as a basic piece of apparatus for routine photography in a small space Dr. Schiller's method is worthy of study. As it is especially designed to give flat lighting for color photography, no pictures of the results obtained with the apparatus were included in the article.

Pathological Atlas in Color

"Pathological Histology" by Dr. Robertson F. Ogilvie of Edinburgh University is, we hope, a forerunner of many textbooks and atlases in full color. It contains 220 photomicrographs taken by means of the Finlay process by Mr. T. C. Dodds, Senior Technician in the Department of Pathology. The Graphic Arts Ltd. of London reproduced the plates, and the whole has been republished in this country by the Williams and Wilkins Co. Dr. Ogilvie compiled this book with both graduate and undergratudate students in mind. He considered color-plates necessary because these have the advantage of showing not only the morphology but the staining reactions of the tissues, an important feature where, for example, staining for fat or amyloid is necessary. Such pigmentary changes as those due to blood-pigment or melanin are clearly seen in the color-plates, just as they appear in the prepared section of tissue.

Only the authors, photographers and publishers of scientific books can appreciate the painstaking work entailed in illustrating them ade-

quately. In a pioneering undertaking of this sort, with the hazard of color added, only the greatest exactitude and the closest cooperation among all concerned could have produced such results. Dr. Ogilvie, Mr. Dodds, the Finlay Company and Graphic Arts Limited are all sincerely to be congratulated. A few plates are open to criticism, probably because of imperfections in the original slides, for the most part. In a book of such wide scope some uneveness must be expected. But taken as a whole the quality of reproductions is so high that Dr. Ogilvie understates the case when in his preface he remarks that "of the superior appeal of colour there is no doubt and it is therefore hoped that compared with monochrome prints these coloured pictures will convey a much more realistic impression of what the microscope reveals in stained preparations."

SUSTAINING MEMBERS

The following have been renewed as Sustaining Members for 1940-41, to date:

Louis Paul Flory
Boyce Thompson Institute
for Plant Research, Inc.
Yonkers, N. Y.

Dr. George H. Semken
16 W. 85th St.
New York, N. Y.

Miss Anne Shiras
University Office,
Magee Hospital
Pittsburgh, Pa.

Lloyd V. Varden
Agfa Ansco Corp.
Binghamton, N. Y.

OUR SUSTAINING MEMBERS

The B.P.A. wishes to express its appreciation to the members who are entering or renewing in the Sustaining Class. Each of these members is worth eight regular members to our exchequer. They make possible activities that, without them, would have to be postponed pending a larger membership. Their selection of this type of membership is a gesture of cooperation and support, since their privileges are no different from any other member's. In other words they get nothing extra for their money except the knowledge of having given the Association a boost, and we appreciate their considering this a good investment.

When the June 1940 Journal was going to press a mistake was made; a wrong paper was pulled from the files and this resulted in our

printing a list of Sustaining Members which was not up to date. The names of Dr. Arthur Proetz, of St. Louis, Missouri, and Mr. Lloyd Varden, of the Agfa Ansco Company did not appear on the list, although they have been Sustaining members throughout 1939-40. It is an error we deeply regret because it gives the impression that we take our Sustaining Members lightly. Nothing could be further from the fact. We offer our apologies herewith to Dr. Proetz and Mr. Varden.

New Members

We take pleasure in announcing the following new members:

Alhand, Richard J., 1217 Chandler Street, Danville, Illinois.

Anderson, Albert U. (*Jerome C. Diebold*), 113 W. Gorham, Madison, Wisconsin.

Bautsch, Francis A., S.J. (*Leo Massopust*)***, 1131 W. Wisconsin, Milwaukee, Wisconsin.

Burress, Paul D., P. O. Box 222, Winter Park, Florida.

Candel, Dr. Samuel (*Lester Bergman*), 3021 Avenue I, Brooklyn, N. Y.

Davis, Roger (*Louis Schmidt*)*********, Paris, Maine.

Dorne, Dr. Maurice (*Chicago Chapter*), 104 S. Michigan Avenue, Chicago, Illinois.

Franefield, Mary, 426 E. 26th St., New York, N. Y.

Freeman, William N., Jr. (*F. R. Harding*)***, 12 Van Norden St., Cambridge, Mass.

Furner, Milton (*E. E. Myers*), Philippi, W. Va.

Glaze, James B. (*Wm. L. M. Martinsen and John A. Maurer*), 1649 E. 77th St., Chicago, Illinois.

Harris, Herbert J. (*Louis Schmidt*)*********, 237 W. 107th St., New York, N. Y.

Koch, Dr. Ferdinand (*A. Marfaing*)**, The Institute of Ophthalmology, 635 W. 165th St., New York, N. Y.

Lawson, Howard B. (*Frederick J. Maisel*), 573 E. 22nd St., Brooklyn, N. Y.

Milne, Lorus J. (*Louis Schmidt*)**********, Randolph-Macon Woman's College, Lynchburg, Va.

Morrison, Ralph H., 1211 Marion St., Seattle, Washington.

Nelson, Norman M., D.N.M., U. S. Regional Research Lab., East Lansing, Mich.

O'Callaghan, John P., 734-A Ocean View Drive, Honolulu, T. H.

Reyniers, Dr. James A. (*Leo Massopust*)****, Laboratories of Bacteriology, University of Notre Dame, Notre Dame, Indiana.

Roberge, Miss Agnes, 1924 Comox Street, Vancouver, B. C.

Shipman, Emmett E. (*Louis Schmidt*)**********, 303 W. High Street, Urbana, Illinois.

Tarquinn, Nick (*Ralph Creer*)**********, Box 2297, Hines, Illinois.

Thuringer, J. M., M.D., (*Wayne M. Hull, M.D.*), 801 N.E. 13th St, Oklahoma City, Okla.

Whiting, Joan M., St. Luke's Hospital, Chicago, Illinois.

Wile, Edgar J. (*Louis Schmidt*)**********, 320 Riverside Drive, New York, N. Y.

Womack, E. M. (*Louis Schmidt*)**********, 1029 Niels - Esperson Bldg., Houston, Texas.

HONOR ROLL

The B.P.A. began a drive, dating from the 1938 Convention for one new member for every old. Here is a list of those who have filled their quota:

Adams, John F.	*	Lown, W. C.	**
Bergman, Lester	*	Maisel, Frederick J.	*
Brown, L. B.	**	Marfaing, Adolph	**
Brown, Margaret	*	Martinsen, W. L. M.	*
Brues, C. T.	*	Massopust, Leo	****
Cohen, Mortimer	*	Maurer, John A.	*
Creer, Ralph P.	**********	Meigs, R. C.	*
Dick, David W.	*	Meyers, Dr. E. E.	*
Diebold, Jerome C.	*	Patten, Wm. E.	*
Forney, Emil	*	Poppel, Joseph	*
Foust, H. L.	*	Proetz, Arthur	*
Harding, F. R.	****	Richards, Oscar	*****
Haulenbeck, J. B.	**	Ross, Elizabeth	*
Helmbold, Dr. T.	**	Royce, Clayton E.	**
Henry, Chester O.	*	Ruslander, Frank	***
Horton, N. S.	*	Sadler, Albert	*
Hull, Wayne B., M.D.	*	Schmidt, Louis	**********
Iorio, Adrian J.	*	Skelton, David	*
Joyce, Dr. F. W.	*	Zimmer, Stella	*
Julin, Leonard	*	Chicago Chapter	*
Las Casas, Herman de	***	Pittsburgh Chapter	*********
Lester, Henry	*		

* Each asterisk designates a new member.

CORRECTION!!!

On page 151 of Volume 8 the name printed as Gonzalez, R. Baquero, M.D., should read: Baquero Gonzalez, Ricardo, M.D.

Forestry

The Journal of the Biological Photographic Association

DEC 9 1940

DECEMBER

1940

VOLUME 9 NUMBER 2

LEO C. MASSOPUST,
EDITOR

For the advancement of photography in relation to the biological sciences.

OFFICIAL PUBLICATION OF THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION

Published Quarterly For The Biological Photographic Association
At 1300 National Avenue
Waukesha, Wisconsin

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COPYRIGHT, 1940

PUBLISHED QUARTERLY FOR THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION INC. AT 1300 NATIONAL AVE., WAUKESHA, WIS.

Entered as second-class matter at the Post Office at Waukesha, Wis., under the act of March 3, 1879.

Subscription price $3.00 per volume. Single copies 75 cents.

The Journal of the Biological *Photographic* Association

Official Publication of the Biological Photographic Association

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VOLUME IX

NUMBER 2

DECEMBER, *1940*

A stalagmite structure in La Cueva Chica.
1 No. 2 Superflash on camera, lens at f. 12, Panatomic X film.

"Calcium cup" structures.
1 No. 2 Superflash on camera, lens at f. 12, Panatomic X film.

Factors in Cave Photography

by S. C. Dunton*

THE primary purpose of this paper is to present certain facts pertinent to photography in caves, the recording pictorially of structural features contained therein, and the photography of the various living creatures to be encountered.

It seems to the author that the best way of doing this is to divide the ensuing text into two different parts: (1) Still Photography, and (2) Motion Picture Photography. Some of the factors employed in the production of motion pictures in caves (such as illumination) may be used as well in still work, while the best methods of illumination for stills will not be found to be suitable for motion pictures.

The material presented herewith is the result of an expedition by the New York Aquarium in March 1940 to the caves of San Luis Potosi in Mexico, for the purpose of studying and obtaining live specimens of the blind cavefish peculiar to a certain cave in this region. The author accompanied this expedition for the purpose of obtaining both stills and motion pictures of the work of the expedition. The illustrations are from a particular cave examined in some detail by the members of the party and known locally as *La Cueva Chica.*

This cave, while unlike many caves in respect to formation, offered a variety of photographic subjects likely to be found in any cave encountered, structures such as stalactites and stalagmites, vaulted chambers, an underground stream, and various kinds of life such as bats, crayfish, blind fish, spiders and scorpions.

It should be noted that cave exploration and photography are generally of a rigorous nature and call for a fair amount of physical stamina. Great changes of temperature and humidity are nearly always encountered, and the operation of complex equipment in near or total darkness is not pleasant over extended periods of time.

In both still and motion picture photography of caves there are generally three types of subject to be recorded.

1—General physical aspects of the cave and details of certain structures.

2—Research carried on in the cave by the exploring party and details of such operations.

* Received for publication November 9, 1940 from the New York Aquarium, New York City.

Near the end of the cave. 1 No. 9 Superflash on camera, lens at f. 3, Panatomic X film. Floating debris on surface of water is caked bat dung.

3—Various forms of life inhabiting the cave.

In both still and motion picture photography there are three general conditions likely to be encountered that will make work difficult. 1—Difficulties of transportation; 2—Changes in temperature and humidity; 3—Difficulty in setting up equipment.

Still Photography

In considering the best type of camera equipment for making still photographs, it should be remembered that weight is a very important item. Bulky equipment, such as view cameras of the larger size and heavy tripods, are decidedly not an asset when one has to traverse long distances in the dark or crawl through narrow passages. Furthermore in many caverns one encounters bodies of water and underground streams of varying depths which have to be waded, or in many instances swum. Such a condition was encountered in La Cueva Chica, where we employed a portable canvas boat. In places inaccessible by boat due to

the close confines of the passages, the photographic equipment was placed in 5-gallon gasoline tins and carried on a small raft or ferried along by swimmers.

A camera of the 4 x 5, or 3¼ x 4¼-inch size, should be selected as the smaller "candid" types may not render minute detail or texture as sharply as will the larger sizes.

A reliable flashbulb synchronizer should be attached to the camera, for only with a high speed flash exposure can one obtain clearly defined cave pictures in which people are moving about. It will generally be found that speeds of from 1/150th to 1/250th of a second will be fast enough for most scenes encountered, but in the event that flying bats appear in the picture, an exposure of at least 1/500th of a second (obtainable with a focal plane shutter synchronizer) must be used. At speeds less than 1/500th second blur will occur in the wing movements that may render the negative unusable.

In the majority of cave work the new small flashbulbs (Wabash Press 25 or General Electric No. 5) will be found to be very useful; in the new type of high-efficiency concentrating type of reflector they may

Blind cave fish at surface of pool.
1 No. 2 Superflash on camera, lens at f. 16, Panatomic X film.

be used for photographing objects out of reach, bats hanging from high ceilings, etc. In these and subjects of a similar nature a telephoto lens would be of considerable help, enabling the photographer to record otherwise inaccessible detail.

However, the author used the standard sizes of flashbulbs in regular equipment with good results. In addition to this equipment, several extensions for auxiliary flashlighting will be useful, and a supply of rubberized cloth will be needed for wrapping equipment and for use in the cave where it may be impossible to find dry surfaces upon which to set various pieces of equipment. Lens tissue is also an item that is practically a necessity, for in cave work, much trouble will be encountered with lens fog, as there is usually a great difference between outside conditions of temperature and humidity and those in the cave. This fog will in many instances affect the rear elements of the lens as well as the front and for this reason the lens should be readily detachable from the camera for cleaning.

The use of flash powder in cave photography is not recommended, for if it becomes in the least way damp, it will explode upon use. Furthermore, it cannot be used for action shots as it is difficult to devise a reliable synchronizer for its use at high speeds. If it must be used it should be packed in small, individual water-proofed loads, or obtained in water-proofed cartridges.

A light but strong tripod is a necessary item on the list of equipment. It should not be the type that requires adjustment by turning the ends of the legs, for in many instances you will have to set up in mud and water. A range-finder of the double-image type, requiring a relatively high amount of illumination is not of much use, unless the image of a candle or lamp can be placed directly on the location to be photographed, and for this reason a camera with a focusing back or an accurate focusing scale is suggested.

Film packs will be found to be generally more useful than cut film as they lessen the amount of weight to be carried and are more easily manipulated in the dark.

Before starting into any cave the photographer should spend considerable time learning to operate his equipment in total darkness, for it is surprising how equipment which you have handled for years becomes unfamiliar when you are forced to work with it in total darkness or by the partial illumination afforded by candles or electric hand lamps.

An emergency candle as well as matches in a water-proof container should always be carried in the event of failure of regular working lights.

Clothing to be worn depends on the type of cave to be investigated,

Collecting cave fish in La Cueva Chico. 1 medium magnesium flare used at right of picture. Lens at f. 3.5, Ultra Speed panchromatic film. (Enlargement from 35mm. Cinema film.)

A netful of cave fish. 1 No. 1 photoflood on battery current. Lens at 3.5, Ultra Speed panchromatic film. (Enlargement from 35mm. Cinema film.)

but in any type of cave heavy canvas shoes with the soles equipped with rubber suction cups will be found to be very useful in traversing slippery floors or wading about in water.

In photographing a cave that has or has not been explored it is the best policy to make a number of reconnaisance trips to familiarize oneself with the cave and its photographic possibilities. On such trips it is advisable to take a still outfit along, and photograph any section of the cave if there is reasonable doubt that you may not revisit it. For instance, in La Cueva Chica, the author, accompanied by three other members of the expedition, made photographs of the extreme end of the cave, accessible only by boat. This was the only trip made to the extreme end and we were thus able to supply what would have been an otherwise incomplete pictorial record, had not the equipment been available at all times.

In entering a cave or unexplored section of a cave, the usual precautions of testing the air with a lighted candle should be observed. If the flame burns readily the air should be found fit to work in. Such a procedure is inadvisable in regions where there is any possibility of explosive gases filtering into the cave. Here tests generally used by miners, such as carrying a live canary, may be used.

In the actual camera set-up in the cave it will be found that for general recording of detail a more or less flat lighting may be employed, but in close-ups of particular structures an extra modeling light used on an extension may be more effective. As a basic lighting the author generally adhered to the table given below. Walls of the cave were a dark grey or dark brown color and afforded little reflection of light, except where wet. Flash was used on or near the camera. Film used was Panatomic X.

Distances to	10 ft.	1 No. 2 Superflash at	F 16
Distances to	20 ft.	1 No. 2 Superflash at	F 12
Distances to	30 ft.	1 No. 2 Superflash at	F 9
Distances to	50 ft.	1 No. 3 Superflash at	F 9
Distances to	100 ft.	1 No. 3 Superflash at	F 6.3

Shutter speed was set at 1/150th of a second. Additional side lighting by one bulb on extension should be regarded as a modeling light only, and should not be figured in computing the basic exposure. With the above factors given, the lens was stopped down considerably more than the tables given by the flash-bulb manufacturers suggest, but with development in D-76 borax formula normal density negatives resulted.

After a day's work in a cave, cut film should be carefully repacked in the original box with the paper separators replaced between each film, unless processing is done in the field. In regions where the temperature

and humidity is high, either in the cave or where the film is stored, it will be necessary to place a handful of heated rice in the can or jar in which the film is to be stored. The container should be sealed after this is done. This is especially important with cut film or with 35 mm. stock. Film packs and roll film have a protecting coating over the emulsion which will protect them to some extent.

Motion Picture Photography

In motion picture photography of caves, lightness of equipment is again an asset. In 35 mm. work, cameras of the news reel, 100-foot type, will be found to be most useful. The Eymo and Devry spring-driven cameras are the easiest to transport and operate. The fastest type of Panchromatic film available should be used, as lighting equipment at the best will not be too efficient. A 2-inch lens of wide aperture should be used, and a four or six-inch lens also of wide aperture will be a useful adjunct.

There are two types of illumination available to the cave photographer: magnesium flares and photoflood light. Both have their advantages and disadvantages. The flares must be carefully protected against dampness or they will explode. In all instances they should be waterproofed by the manufacturer.

Their chief disadvantage is that they give off a large amount of light-colored, disagreeable smoke. While this smoke is unpleasant to smell, it is non-poisonous—but in caves that are not very well ventilated, it hangs in clouds and makes further photography impossible.

However, for large chambers and high ceilings they afford the only satisfactory illuminant for motion picture work. For work in easily accessible sections of caves, for distances up to fifteen feet, it is possible to use two No. 1 photoflood bulbs at an aperture of f. 2.9 when photographing at sound speed, (90 feet per minute, 1/50th of a second per frame). These two bulbs should be used in reflectors that tend to concentrate the light rather than spread it widely. Two No. 1 photofloods may be operated in series with three 45-volt heavy-duty radio "B" batteries, if not operated for more than a minute or two at a time. Under these conditions the batteries will have an effective life of from 10-15 minutes. Shots at 15 feet should be made first, as upon use the batteries break down rapidly, and after a few shots will deliver about fifty percent of their initial light output.

If available a small hand or gas-driven generator may be used and with such a device it may be possible to operate up to six No. 1 photofloods, with a corresponding increase in area photographed. The total

weight of such equipment might be about the same as the three "B" batteries.

The efficiency of flares will be increased considerably if white tin reflectors roughly three feet square are placed behind them. The flares may be obtained from most large manufacturers of fireworks and are inexpensive. One flare without reflector is sufficient for distances up to fifty feet. The medium flare, burning for thirty seconds, is the most convenient to use, and the instructions accompanying them should be carefully followed. If people are facing the flare and are photographed with a flat lighting at closer than twenty feet, over-exposure of the faces and other light colored objects present will result, at an aperture of f. 3.5 when using ultra-speed film. It will be found that in side lighting with two flares, one being used as a modeling or back light, the most natural effects will be obtained. In other words, the effect of darkness will be preserved, with the detail photographed still evident.

In reloading motion picture cameras in caves the utmost care must be exerted to avoid getting dirt and moisture from the roof into the camera or film cans. This is especially true where large numbers of bats may be flying about. The author remembers one instance where he had to wade and swim nearly a quarter of a mile to the exterior of La Cueva Chica to clean his camera of bat droppings deposited there when he, in an attempt to change film, opened it while hundreds of bats wheeled about overhead. It was impossible to open the cameras elsewhere in the cave save for brief periods, due to water dripping from the roof, or dust dislodged by the investigators in their work.

In conclusion it might be of interest to the reader to note a list of the actual photographic equipment used on the aforementioned expedition. Equipment mentioned in the text, but not in the following list, represents items not actually used on the expedition, but which have since undergone inspection or tests and which would be used by the author in future work of this nature.

Endoscopic Photography*

by Wayne M. Hull, M. D.†

FOR several years remarkable progress has been made in the development and application of endoscopic instruments for visualization of the various body cavities. These have become accepted as most valuable aids in the diagnosis of diseases affecting internal structures of the body. Many surgeons have had their findings laboriously illustrated by artists to record important pathological changes found, a procedure that is quite time consuming, generally very unpleasant to the patient, and usually rather expensive. In many instances, the artist must complete the illustrations from memory, which often leads to inaccurate reproduction. It has been the hope of the medical profession for some time that photographic methods would be perfected to simplify the recording of anatomical changes observed within the body.

The application of photography to endoscopy has been rather slow, due to the difficulties encountered in producing photographic apparatus for this highly technical work. Obviously, the camera used must be small to avoid interference with the work of the operators. It must also be light in weight to insure easy manipulation and steadiness while the pictures are being made. It is essential that the camera be secured firmly to the endoscope and provide a means for the surgeon to look through the instrument to locate the desired field quickly, and to allow immediate exposure when the area has been found. The exposure must be very short because of unavoidable body movements such as respiration, heart beat, and peristaltic waves, any of which may cause blurring of the pictures.

The problem of adapting the camera to the endoscope may be complicated, depending upon the type of camera selected and the accessories available. The lens of the camera is removed and some type of adapter provided to fasten it securely to the telescope of the particular endoscope at hand. For the past three years, the well known Leica camera has been used in developing the technic and methods presented in this work. It is attached to the telescopic portion of the various endoscopes by means of the Micro-Ibso attachment available for the Leica camera in making photomicrographs. Fortunately, the Micro-Ibso is made with a side telescope through which the operator visualizes the field and instantly makes the exposure as soon as it is found. The endoscopic instruments

* Presented at the Annual Convention of the Biological Photographic Association in Milwaukee, September 12, 1940.

† Balyeat Clinic, Oklahoma City, Oklahoma.

most used were those manufactured by the American Cystoscope Makers, Inc., and include their cystoscope, thoracoscope, and peritoneoscope. The telescopic portion of the peritoneoscope was utilized for the bronchoscopic photography reported here. These are all fine precision made instruments and many of the parts are interchangeable, which often is a great convenience. The proctoscope with the interchangeable tubes, although an old model, is the standard instrument, made by the Cameron Surgical Company. The Schindler Flexible Gastroscope used in this work was made by Carl Zeiss.

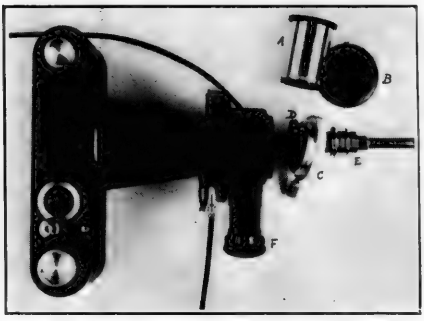


Figure 1. Micro-Ibso attachment showing method of adaptation to the endoscopic telescope. (A) Microscope eyepiece. (B) Large bakelite eyeshield. (C) Knurled collar which secures endoscope to base of Micro-Ibso attachment. (D) Small bakelite eyeshield. (E) Endoscopic telescope. (F) Side telescope through which operator visualizes the field.

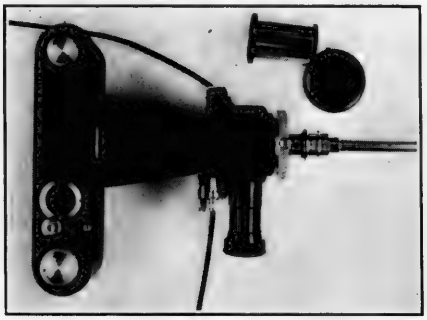


Figure 2. Micro-Ibso attachment with endoscope firmly secured to the base ready for use.

The adaptation of the Micro-Ibso attachment to the endoscope is not difficult. Briefly, this is accomplished by replacing the microscope eyepiece (ordinarily secured to the base of the micro-adapter) with the eyeshield of whatever endoscopic telescope used. The diameter of the shield is approximately the same as the microscope eyepiece; if not, a small one can be obtained, since the thread accommodating the eyeshield to the telescopes of the various A. C. M. I. instruments is standard.

Problems involving the optics of the system may require considerable adjustment by trial until the image produced by the telescope is brought into proper focus in the film plane of the camera. In adjusting the optical system of the telescopic portion of the endoscope to the micro-adapter, it is necessary to bring the ocular of the telescope very close to the base and to hold it in this position firmly. To make this possible the black bakelite eyeshield is unscrewed from the telescope and the base of the collar filed down until the ocular is almost even with the rim of the

eyeshield. It is advisable to use some type of focusing tester (with ground glass screen) on the micro-adapter for study of the image during the process of filing down the collar to its proper thickness. The Leica single exposure camera is ideal for this purpose as the ground glass screen corresponds exactly to the film plane of the regular Leica camera. The attachment costs very little and is easily attached or removed. In working out the focusing adjustments, a piece of paper with small print placed about one inch from the distal end of the telescope is very advantageous, as the image of the letters can be seen very clearly on the ground glass screen. When the letters appear sharp and clear throughout the field, the adjustment can be considered complete. It is not necessary to repeat this procedure each time the instrument is used unless for some reason clear pictures are not obtained. The adaptation to the various endoscopes, including the cystoscope, peritoneoscope, bronchoscope, and gastroscope is made in the same way, and with the exception of the gastroscope the same eyeshield can be used interchangeably for all these instruments.

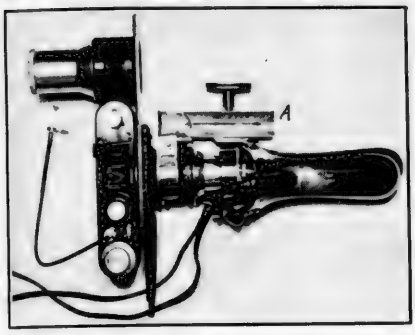


Figure 3. Vaginal speculum, camera and sliding copying attachment. (A) Coarse focusing mechanism of an old microscope.

Photography with the Vaginal Speculum

The vaginal speculum is perhaps the simplest instrument for adaptation to the camera. In the method described here, the camera is rigidly secured to the speculum to maintain correct alignment at all times. The

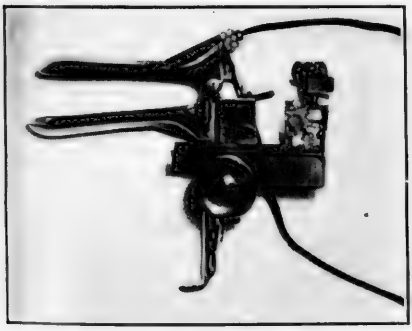


Figure 4. Lateral view of speculum and focusing base for camera.

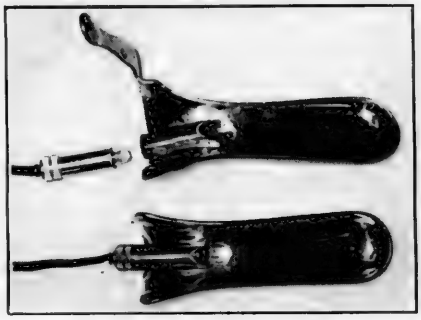


Figure 5. Blades of vaginal speculum showing lighting arrangement.

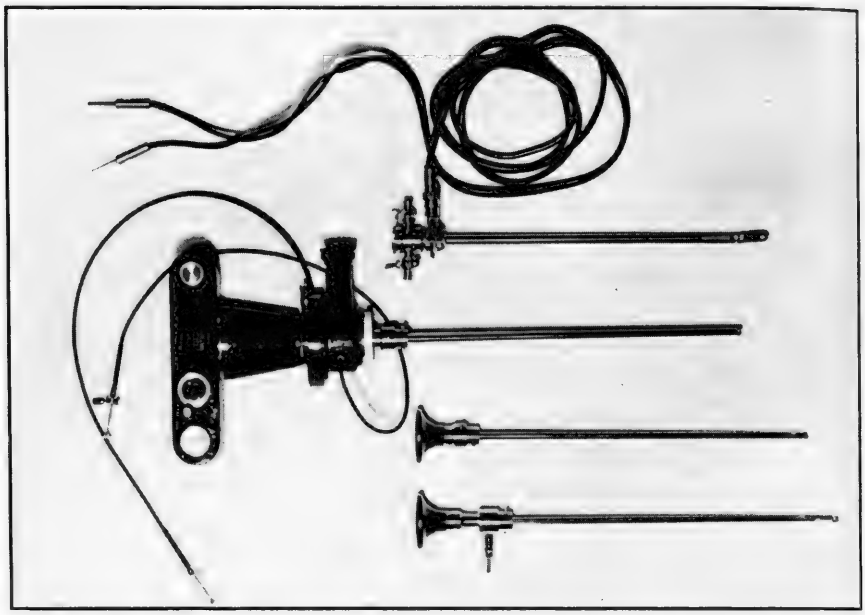


Figure 6. Camera attached to cystoscope.

Figure 7

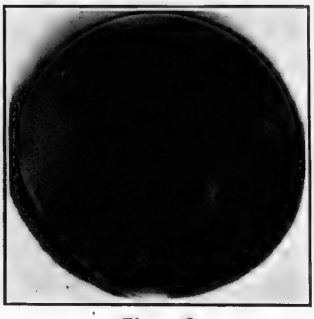


Figure 8

set-up is shown in figure 3 in which the coarse focusing mechanism of an old microscope has been soldered at one end to the frame of a large Graves Speculum, and a small metal base plate to support the camera is soldered to the other end of the focusing mechanism. The set-up may be held with one hand during the exposure, or a tripod may be used to support the speculum for the exposures after the instrument has been introduced. There are definite advantages in securing the camera firmly to the speculum, particularly from the standpoint of anatomical variations in different individuals. Also, with such an arrangement body movements and changing position of the patient on a table does not affect the alignment of the apparatus. If the

Fig. 7. Photograph through cystoscope of ureteral catheter inserted through ureteral orifice. Border of trigone is distinct.

Fig. 8. Photograph of a large bladder stone made through foroblique cystoscope.

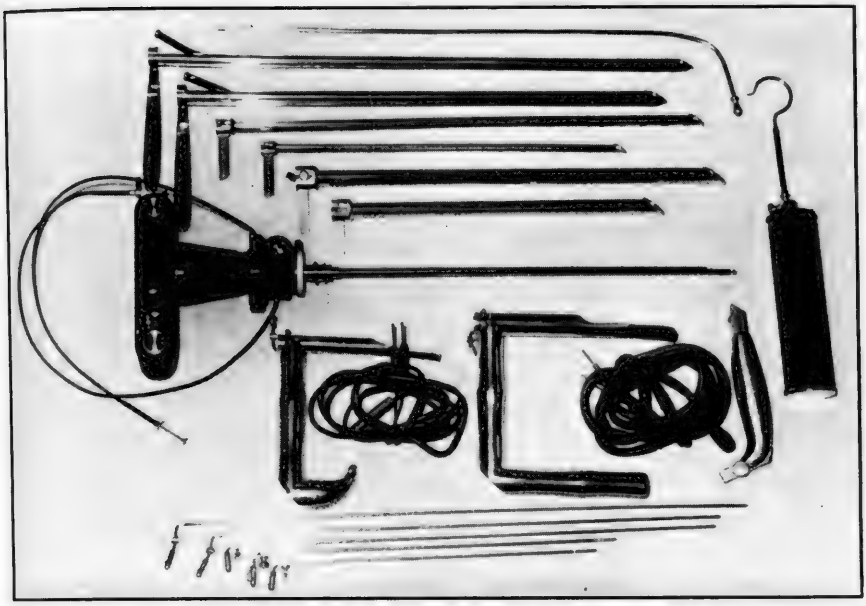


Figure 9. Camera attached to peritoneoscopic telescope with bronchoscopic accessories as used for bronchoscopic photography.

Figure 10. Photograph of the carina showing entrance into right and left major bronchi.

patient should move, no time is lost in re-alignment of the camera and speculum such as does occur when the camera and speculum are used as separate units. The apparatus is compact and easily manipulated, the operator may sit in his usual position and very little time is required for making the pictures. A dry and clean field is essential; therefore, always examine the cervix before the camera is attached to the speculum and carefully mop away any mucus and blood.

A 3 cm. extension tube with the standard 50 mm. lens of the camera provides sufficient magnification. Because of the position occupied by the camera, it is necessary to build lights into the upper and lower blades of the speculum. The lamps fit into small metal tubes

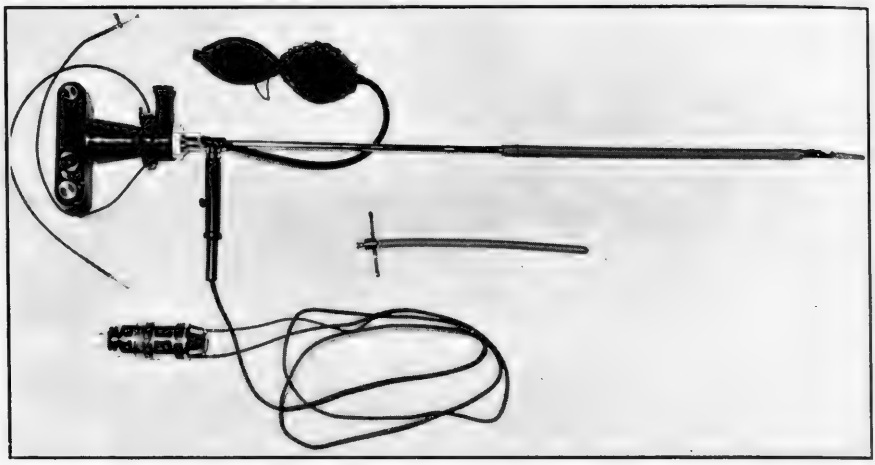


Figure 11. Camera attached to Schindler Flexible gastroscope.

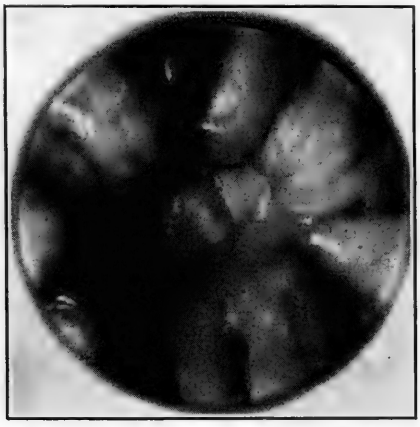


Figure 12. Large gastric ulcer photographed through gastroscope.

soldered into the proximal end of the blades. They are operated from separate rheostats and produce ample light for making pictures in either black and white or color. The lights used are 3.5 volt, made by the International Electric Instrument Company, under the name of "Gyn-A-Lite." They may be removed when the speculum is to be sterilized. With the lights burning brightly it is possible to make short exposures even with the lens diaphragm well stopped down to obtain good depth of focus. With Kodachrome, Type A, at f:12.5, exposures will vary from ½ to 1/20 of a second. With panchromatic film the time is, of course, much shorter.

Other methods have been devised which also give satisfactory results, [1, 2, 3, 4] using the Leica camera and some of the various accessories available for it. Most of the methods reported in the literature use

[1] J. Biol. Photo. Assn., R. P. Creer, Dec., 1935.
[2] Am. J. Obs. & Gyn., Creer and Kimble, 33:162-163, Jan., 1937.
[3] Am. J. Obs. & Gyn., Bruner, Rosebrook & Cushman, 34:1027-1029, Dec., 1937.
[4] J. A. M. A., C. E. Galloway, 111:1996, Nov. 26, 1938.

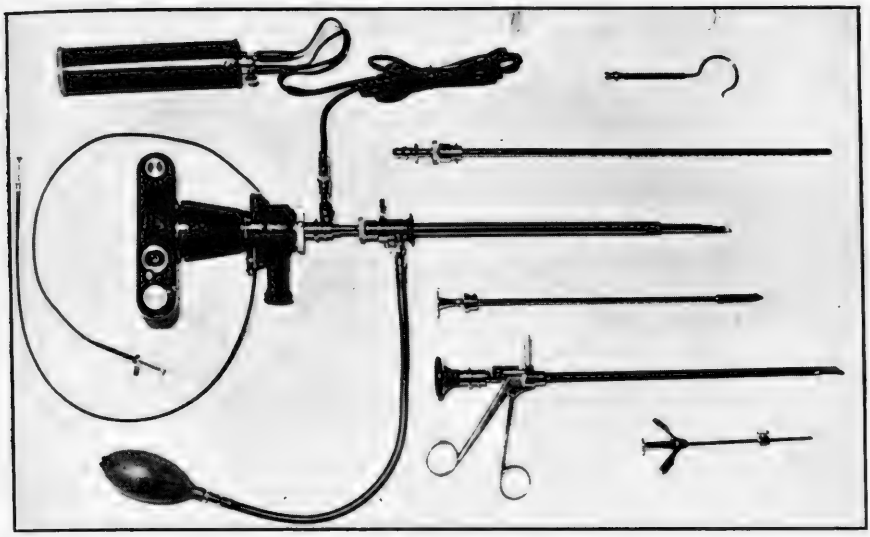


Figure 13. Camera attached to peritoneoscope.

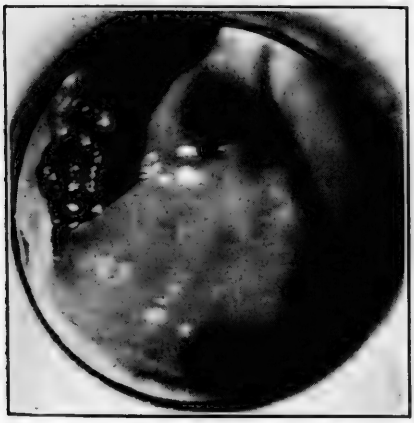


Figure 14. Human ovary and uterine tube photographed through peritoneoscope. Note large Graafian follicle.

telephoto lenses and the camera is operated from a tripod as a separate unit from the speculum.

Cystoscopic Photography

There are several types and makes of cystoscopes on the market, and practically all can be used for photography within the bladder. Some manufacturers provide specially designed telescopes for their cystoscopes, producing foroblique, right angle, retrograde, and wide angle views. The foroblique telescope is probably the most practical for photographic work. The distal and ocular lenses must be clean and free from scratches. It is an advantage to have two sets of telescopes so that one may be fastened to the camera while the other is used by the urologist for visualization until ready to make the photograph. After introduction of the telescope into the bladder, the operator views through the side telescope of the micro-adapter to locate the field and an assistant makes the exposure the moment it has been found. For rapid and accu-

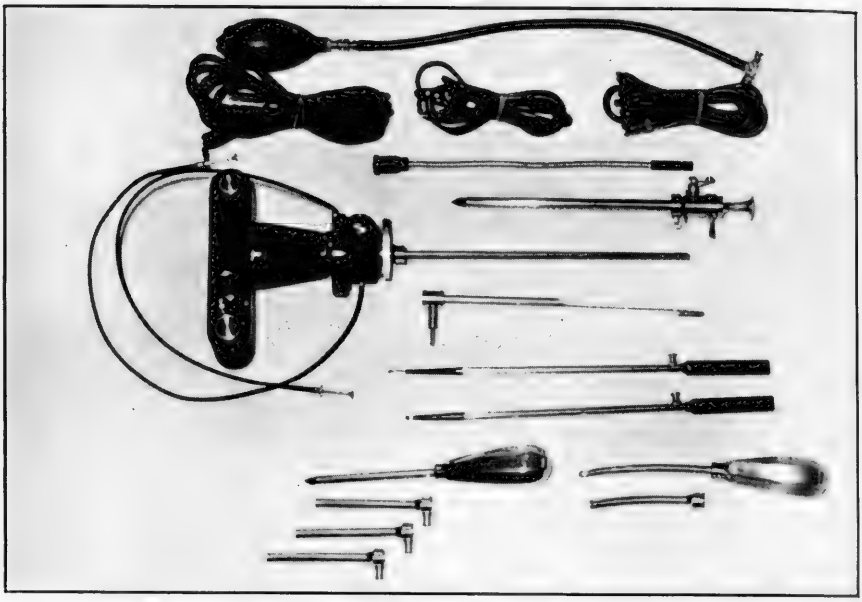


Figure 15. Camera attached to telescope of thoracoscope; and thoracoscopic accessories.

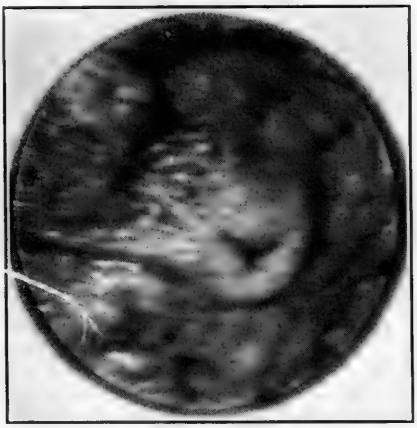


Figure 16. Metastatic carcinoma surface of lung made through thoracoscope.

rate work, the synchronized high-low resistance switch is a great advantage. Unless the urologist has had experience with and understands photography, it will be advisable to make two or three exposures at different shutter speeds to insure obtaining one view which is usable.

In all endoscopic work, the clinical photographer as well as the surgeon should anticipate the possibility of body movements. The best time to make the exposure is at the end of expiration when there is normally a short pause, usually sufficient to allow an exposure up to one second. Panchromatic film of the highest emulsion speed is required. Agfa Ultra Speed Panchromatic film is very satisfactory and was used for most all endoscopic photography throughout this work. The film

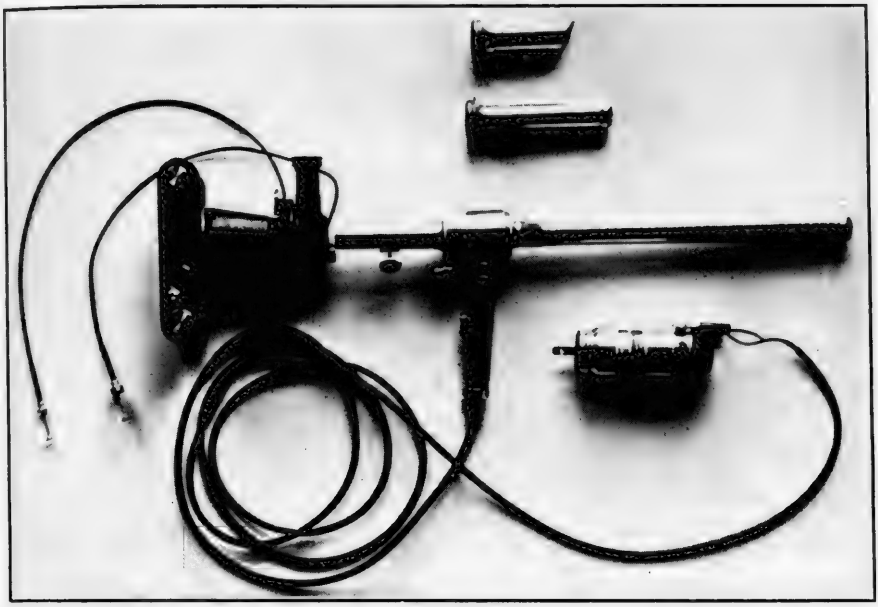


Figure 17. Camera attached to proctosigmoidoscope.

Figure 18. Adenocarcinoma of sigmoid made through proctosigmoidoscope.

must be fresh and should be developed immediately in one of the many fine-grain developers available.

It is important that the bladder be washed out well with water before attempting photographs. Cloudiness due to pus, urinary sediment or blood greatly decreases contrast and interferes with proper reproduction. The bladder should be filled (but not greatly distended) with water to prevent undesirable reflections from the surface of the field to be recorded.

Bronchoscopic Photography

Pathological changes involving the larynx, trachea, the bifurcation, and proximal portions of the major bronchi can be recorded satisfactorily by photographic means. For this purpose some type of telescope that will

reach the lesion is necessary. It is very practical to use the telescope of the peritoneoscope as it has a foroblique vision, built-in light system, and easily reaches the bifurcation of the trachea in the average patient. A lesion more distant than the bifurcation requires a longer telescope; one of about 50 cm. length which can be obtained from the American Cystoscope company on special order. Generally it is better to dispense with the metal bronchoscope tube as the lumen is comparatively small, and the space occupied by the telescope greatly diminishes the air passage, so that the patient may suffer from anoxemia. Usually the laryngoscope for the purpose of retracting the epiglottis and separating the vocal cords is all that is required, thus permitting the patient to breathe without difficulty. The telescope and its lenses are warmed before introduction to avoid condensation of vapor over the objective surfaces.

In bronchoscopic photography extension lights normally provided for the bronchoscope may be utilized to advantage in supplementing the light on the telescope. As a rule, this is not necessary since the trachea is a small cavity and the light does not scatter as badly as it does in larger cavities. Exposures are best made immediately after expiration. Individuals who breathe rapidly may sometimes be given a sedative to slow down respirations, thus allowing more time for the exposures and thereby decreasing the danger of movement during exposure.

Gastroscopic Photography

The gastroscope has become a very important diagnostic aid in recognizing gastric pathology, especially ulcer and cancer. A number of attempts have been made to photograph through the instrument, but it has been quite hard to obtain good pictures for various reasons. Although the intensity of the light from the gastroscope is greater than any of the other endoscopic instruments because of a larger light bulb, the great distance from the site of the lesion to the photographic plate greatly reduces the amount of light which eventually reaches the film. The adaptation of the camera to the Schindler Flexible Gastroscope is made as previously described for other endoscopic instruments, and may be attached before or after the instrument has been introduced. Preferably, the camera should be left off until the operator has visualized the inside of the stomach and located lesions worth photographing.

The light source at the distal end of the instrument operates from a small rheostat which may be turned to high intensity at the time the exposure is made, or a high-low synchronized switch may be connected. Exposures with Agfa Ultra Speed Film will vary from 1/20 to a full second. It is difficult to make longer exposures due to unavoidable body

movements, which in this area are more noticeable than in any other part of the body due to strong peristaltic contractions in the stomach, diaphragmatic motion, and the heart impulse.

In recording lesions within the stomach, the lens of the gastroscope should be brought quite close to the field as this also brings the light nearer to the lesions which greatly intensifies the image. Ulcers and malignant changes photograph surprisingly clear even though only in black and white. Color certainly will be an advantage because of its value in differential diagnosis, and it is very probable that before long lighting improvements will make its use possible.

Photography with the Peritoneoscope

The peritoneoscope is a comparatively recent addition to the endoscopic family of instruments, but it is equipped with an optical system of good quality and renders very clear photographic reproductions. The instrument and its accessories (except camera) must be sterilized before use. To prevent contamination from the photographic apparatus, it is advisable to provide a cloth hood for the camera with a sleeve through which the cable releases and the winding mechanism can be operated. Obviously, the cloth hood is sterilized before use and then the camera carefully placed inside. Although the danger of contamination is not great, yet every precaution must be taken to prevent any such accidents occurring. The photographer, of course, wears sterile gown and gloves and after grasping the camera in its sterile hood does not remove his hands again until the procedure is completed.

When possible two telescopes are an advantage, one being used for normal visualization, the other attached to the camera in readiness for photographs when lesions within the peritoneal cavity, if any, have been located. Photography within the abdominal cavity should be withheld until the last. In other words, exploration with the peritoneoscope or biopsy taking should be done before an attempt is made to photograph. Once the telescope to which the camera is attached has been introduced into the cavity, it should not be removed until the work is finished. After removal it must not under any circumstances be introduced again until the telescope and other portions of the peritoneoscope have been again sterilized.

Most structures within the peritoneal cavity photograph with surprising clearness, although distortion is more noticeable, especially when close up. The uterine tubes, ovaries, uterine fundus, tumor masses, intestine, etc. record quite satisfactorily and usually without much difficulty, since body movements in the lower abdomen are not as bothersome as those in the upper abdomen or in the chest cavity. The high-low

resistance switch is of distinct value here as described elsewhere. The surgeon should keep in mind that the field lens of the telescope should be brought as close as possible to the object to be photographed. This obviously brings the light closer, and, therefore, a more intense illumination of the image. Needless to say, the operator must be careful not to touch any of the internal structures with the light turned up to full intensity. Exposures usually vary from ¼ to a full second.

PHOTOGRAPHY THROUGH THE THORACOSCOPE

These instruments are designed for visualization of the pleural cavities, biopsy taking, pneumolysis, etc. The telescopes of thoracoscopes are much shorter than those of other endoscopic instruments, which is an advantage because the light travels a shorter distance, producing a brighter image and allowing shorter exposures. The optics of these instruments are very suitable to photography and the images produced are generally sharp and clear. Because the lung is in constant motion it is sometimes advisable to supplement the lighting from the telescope with additional light from another instrument so that short exposures (1/10 second or less) can be made.

Like the peritoneoscope, the thoracoscope and accessories must be sterilized before use and the same precautions taken in regard to contamination from the photographic equipment because infections in the pleural and abdominal cavities are very serious. The camera, cable releases, and micro-adapter must, therefore, be covered by means of a cloth hood that can be sterilized and contain a sleeve through which the operator of the camera can work without danger of contaminating the surgical field.

The thoracoscope made by the American Cystoscope Makers has the same type of eyeshield and standard thread as their cystoscope and peritoneoscope and is, therefore, readily adapted to the camera and micro-attachment. Work in the pleural cavity, of course, must be undertaken only under the direction of a surgeon experienced with chest work because of the danger of producing pneumothorax, hemorrhage, etc. Obviously, the telescopic portion of the thoracoscope is used only through the sheath to prevent intrapleural pressure changes.

Two telescopes are definitely an advantage if the additional cost is not prohibitive. This permits exploratory visualization of the cavity with one instrument while the other telescope attached to the camera can be quickly introduced for making the photographs. Under no circumstances should the telescope with camera attached be reintroduced. When photographs are to be made of an operative procedure within the chest

cavity, two thorascopes are used, one to accommodate the surgeon's instruments and the other for the purpose of making the photographs. Usually the instruments are introduced reasonably close together so that the procedure may be followed closely and photographs made as directed by the surgeon.

When the respiration and pulse are too rapid, some type of respiratory sedative such as morphine may be given to slow the rate. This allows longer exposures which are most satisfactorily made during the short pause following expiration. There is less body movement at this time, the diaphragm steadier, and, therefore, less danger of blurred pictures. There are times, however, when it is necessary to make photographs through the thoracoscope during inspiration, since the surface of the lung is brought nearer to the chest wall. A study of conditions after introduction of the instrument will usually suggest just what phase of the respiratory cycle is indicated for making the actual exposures.

Proctoscopic Photography

Of all endoscopic instruments, the proctosigmoidoscope is perhaps one of the oldest. So helpful is the information obtained from these instruments that in many clinics the proctoscopic examination has become routine. The photographs in this work were made through the old Cameron Proctosigmoidoscope. The camera is attached to the telescope portion of the instrument by securing it to the proximal end in practically the same manner as described for the endoscopes. It is not necessary to file down the eyepiece since the telescope portion of the proctoscope can be focused by means of a focusing screw. It is only necessary to remove the microscope eyepiece of the micro-adapter and replace it with the eyepiece of the proctoscopic telescope.

Three interchangeable tubes are available with most proctoscopes, one tube for anoscopic examination, a longer tube for proctoscopic work, and yet a longer tube for sigmoidoscopic visualization. The light source is contained in the handle of the instrument which also supports the interchangeable tubes. Normally, the tubes are used for visualization by the unaided eye, however, when magnification of a lesion is necessary the telescope attachment specially made for this instrument is quickly adapted.

Since the telescope may be manipulated by a focusing screw, it is necessary to use a lens focusing device with ground glass screen to adjust the telescope for the various tubes used. After the correct position has been determined for each tube, a scratch mark is made on the barrel of the telescope to show the proper setting. The adjustment of the instrument is easy and requires but a few minutes. Exposure obviously

varies with the length of tube used. With Ultra Speed Film, most exposures can be made between ¼ and 1 full second. Lesions which bleed easily are handled carefully, and moisture, blood, mucus, or pus which cause glaring reflections must be mopped away before exposures are made.

SUMMARY

A simplified method has been described for endoscopic photography in which a single camera can be used for all endoscopic work. The adaptation of the camera to the various endoscopes is accomplished by means of the Micro-Ibso attachment intended for photomicography. In this adaptation the microscope eyepiece normally used in the microadapter is replaced by the eyeshield (eyepiece) of the various endoscopic telescopes. The collar of the endoscopic eyshields must be filed down cautiously and checked frequently until the image is sharply focused in the film plane of the camera. No further adjustments are required.

Some type of focusing tester is strongly recommended, as this is the most accurate way of adapting the various endoscopes to the Micro-Ibso attachment. The image produced by the various telescopes may be very sharp in the side telescope in the Micro-Ibso attachment, yet may be badly out of focus in the film plane of the camera; therefore, some type of ground glass screen, the position of which corresponds exactly with that of the film plane of the camera is definitely indicated. The size of the image on the negative produced by the various endoscopes varies slightly, but with the 1/3X conical adapter it is approximately ½ inch in diameter. Other conical tubes of ½ and 1X magnification can be obtained for the Micro-Ibso which produce greater magnification; however, it should be recalled that when an image is enlarged more light is required, and at the present time it is better to use the 1/3X conical adapter with the Micro-Ibso because shorter exposures are permitted.

The greatest handicap at present to the progress of endoscopic photography is the lack of suitable lighting arrangements, as those normally supplied with these instruments for visualization with the human eye do not give sufficient light for the short exposures necessary. In view of the lack of high intensity light bulbs for these instruments, good results can be obtained by using Ultra Speed Film and exposures up to one full second. The use of Kodachrome awaits further development in the improvement and intensification of present light bulbs which will probably be realized within the near future. Synchronization by means of high-low intensity switches to the shutter of the camera is a distinct advantage and increases the useful life of the lamp bulb. There should be full cooperation between doctor and clinical photographer in this rather technical phase of photography.

A Synchronized-Flash Junction Box*

by R. V. Dent†

BATTERY-OPERATED flash bulbs are entirely satisfactory when frequent use is made of the apparatus and the batteries are constantly checked for efficiency. When such apparatus is required for occasional use only, in a hospital, laboratory, or studio, batteries are often found to be run down and they then fail to fire the flash-bulb. This is particularly the case when an electric tripper is used to release the shutter and the flash is where it should be i.e., in the correct position to properly illuminate the subject and not attached to the camera itself. For most work the latter is the worst possible place.

Apart from wiring difficulties, batteries become expensive when many bulbs are to be fired at once. It was for these various reasons that Junction Box described herein was constructed, and a small 12-volt transformer adopted as standard for single-bulb flashes with wipe make-and-break or magnetic-tripper synchronisers. This Junction Box has given good service over a number of years, has nothing to go wrong and does not fail at the critical moment. As it would seem equally useful to any establishment where flash work is occasionally required, the design of such a Box is herein presented. It is not intended for use by Press-men or when a self-contained unit is essential, as the original source of current is from the mains.

The design and use of such a Junction Box is more readily understood if the three basic varieties of flash-bulb synchroniser wirings are made clear. Diagrams A, B, and C show these basic wirings. In every case there must be an electrical make-and-break, in the form of a wiping contact, plunger-contact, switch, press-button, or some other mechanism which will enable the circuit to be closed and opened again. Obviously the actual source of current is immaterial provided it is in correct volume. Excess voltage will burn out a small magnetic tripper, while insufficient voltage will fail to work the tripper and fire the flash, especially when there is much intervening wire.

Small resistances are readily obtainable and reasonable in cost, and work well in place of dry batteries. For firing bulbs without an intervening magnetic tripper or sliding contact, eight volts are sufficient, giving

* Received for publication July 31, 1940.

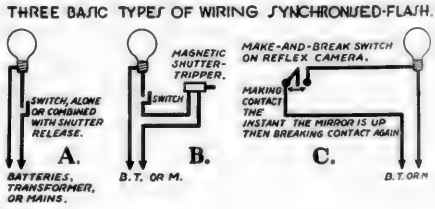
† Associate in Scientific Photography, Henry Lester Institute of Medical Research, Shanghai.

complete certainty of the flash. When much wire is to be used, with magnetic tripper or sliding contact, the use of a twelve volt transformer is recommended for single bulbs. When more than one bulb is to be flashed the regular 30 volt Junction Box is certain to give satisfactory results.

This Junction Box was specifically designed to fire one or more bulbs when using *wiping* or *sliding contact* on the mirror-arm of a Graflex camera, and work up to spring tension four when the camera is set mirror-down, shutter at "O," side lever at "I" as usual. This gives an approximate exposure of ⅛th of a second, but actually in most cases the exposure is the duration of the flash itself, approximately 1/60th.

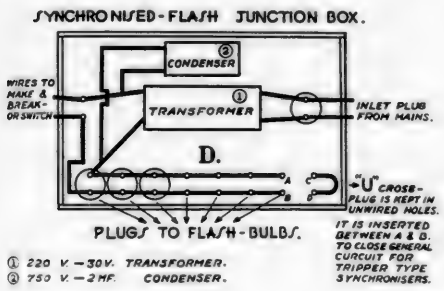
Sparking at the contacts on the camera proved troublesome when using 30 volts and was overcome by cross-connecting a 750 volt 2 MF condenser at the outlet wires of the transformer. It was found that without this condenser the contacts tended to burn away. Platinum tips to the contact points materially improved the condition of the make-and-break, but the trouble ceased after the condenser was installed.

The use of such a Junction Box or small transformer need not interfere with normal battery operation. An extra pair of wires are connected to the base and the side of the lamp-socket, about four inches long, and these are



fitted with receiving plugs of the miniature radio type. Obviously the transformer has merely to be connected to these wires and the circuit is complete. No batteries are placed in the holder.

It is equally simple to construct an entirely separate lamp-holder with the wires entering from the base, but taking the usual reflector at the top. This is merely a piece of wood resembling an electric torch, with a hole along its length to permit the wires to run through it. If this is required for use with a magnetic tripper, it must contain a switch, but with sliding contact on the camera no switch is required. This becomes quite clear when Diagrams B and C are studied.


SYNCHRONISED-FLASH JUNCTION BOX.
② CONDENSER
WIRES TO MAKE & BREAK-OR SWITCH
① TRANSFORMER
INLET PLUG FROM MAINS.
D.
A
B
"U" CROSS-PLUG IS KEPT IN UNWIRED HOLES.
PLUGS TO FLASH-BULBS.
IT IS INSERTED BETWEEN A & B. TO CLOSE GENERAL CURCUIT FOR TRIPPER TYPE SYNCHRONISERS.
① 220 V.—30V. TRANSFORMER.
② 750 V.—2 MF. CONDENSER.

The Junction Box illustrated, wiring diagram D, will fire seven flash-bulbs by direct plug-in connection. There are three standard receiving plugs and four pairs of miniature female plugs. It can be used even when only one bulb is to be fired, and is entirely positive in action. Note that by cross-connecting any of the plugs the circuit is closed, and to accomplish this an inverted "U" plug is kept available in the two blank holes in the base board marked C and D. When the circuit is closed the Junction Box is available for use with magnetic type trippers, always provided the voltage is not too high for the tripper to be used. See Diagram B for wiring.

At first sight it would appear that the use of such a Junction Box would involve interference with freedom of camera operation and a tangle of wires. In practice it is not so; there is actually less cluttering up of the camera than when everything is attached to the camera, with the great advantage that the flash can be placed anywhere it will be most effective. One double flexed wire of a suitable length is plugged into the two receiving plugs permanently fitted on the Graflex, and that is all. In this particular case the wire connecting the camera to the Junction Box is eight feet long. One should avoid the use of extra-light wire, as not only does it tend to get entangled with itself much more readily than normal lighting wire, but it impedes the free flow of current.

It is worth mentioning that for open-and-close flashes, current from the mains at full voltage works excellently, placing the bulbs in whatever type of photographic studio lamp is most convenient. In all cases when working close to a patient, it is a wise precaution to cover

the flash-bulb with an envelope made of ordinary cellophane. This does not exercise any noticeable effect on the intensity of the flash while it is a real protection against flying glass should the bulb explode The higher the voltage used the greater the risk of the bulb cracking or exploding; it occurs rarely but one is not entitled to take any chances when working on a human subject.

To make such an envelope, take a piece of cardboard 6x4½ inches and cut two pieces of cellophane 6½x5 inches and stick three edges of the cellophane to each other from opposite sides, using the cardboard as a guide to keep it in shape. One then has a bag or envelope closed on three sides and open on one narrow end, and this is merely placed over a bulb prior to flashing. It can, of course, be used repeatedly.

COOPERATION WITH THE UNITED STATES ARMY MEDICAL CORPS

From time to time the members of the Association have received information relative to the possibility of organizing clinical illustrative units to serve in the Medical Corps in time of war. In this connection a resolution was adopted by the Association and forwarded to the Surgeon-General of the United States Army. This resolution stated that the Association would be glad to cooperate with the Army authorities whenever called upon.

As a result the Association was furnished with a number of questionnaires to be filled out by the members of our society. The purpose of these questionnaires was to furnish the Surgeon-General's office with a fairly complete list of qualified biological photographers throughout this country.

Approximately 175 questionnaires were returned to the committee and they have been graded and forwarded to the Surgeon-General.

On September 10th the Chairman of this committee had a conference with the proper army authorities in Washington, and an expression of sincere gratitude was expressed for the splendid cooperation of the Biological Photographic Association.

It was suggested that the Association could render a valuable service to the Army Medical Corps by collecting data and specifications relative to the requirements for clinical photographic units which might serve in the event of war. Any ideas on this subject may be sent to the Secretary of the Association or any member of this committee.

Respectfully submitted: Leonard Julin
Henry Morris
Ralph P. Creer, F.R.P.S., *Chairman.*

Color and Illumination in Photomicrography*

by Oscar W. Richards†

A DISTURBANCE of matter gives forth radiation and the radiation depends on the nature of the material and the nature of the disturbance. If a weak electric current is passed through a suitable tungsten wire, the resulting disturbance can be felt as heat and if the current is increased sufficiently, we see that the filament glows. The radiation moves in space from the source until it reaches some object which changes its path or absorbs it. In case the radiation is absorbed, changes occur in the energy of the absorbing medium.

The retina of the human eye absorbs radiations from .4 to .7 of a micron in wave length and this radiation is known as light. We know that radiation of both shorter and longer wave lengths exists, but this cannot be seen because the eye is insensitive to it, although we know of it from other sense organs and by other means of testing instruments. The retina of the eye contains a purplish pigment which is bleached by light and the resulting chemical products initiate nerve impulses. When these nerve impulses reach the brain, we recognize them as sensations of light and color. The eye is not equally sensitive to all colors, but is most sensitive to yellow-green. Objects of this color appear brighter and can be seen with less light than any of the other colors. If we plot the sensitivity of the eye, figure 1, with the greatest sensitivity equal to 100 per cent, we see that the eye is much less sensitive as blue light or as red light are approached. White light is the result of mixtures of approximately equal amounts of light of different colors.

The colors marked on figure 1 are the spectral colors that one could obtain by passing a beam of white light through a prism. With suitable instruments, light may be analyzed and graphed to show the amount of different colors present. However, in nature, we rarely find that any object has a pure spectral color; the natural colors are usually mixtures of the various spectral colors.

Colored objects are colored because they absorb light of certain colors and transmit or reflect light of other colors. A lemon yellow, for

* Received for publication April 29, 1940. A summary of a paper presented to the 1939 Salesmen's Conference at Buffalo.

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instance, absorbs violet and blue light but reflects or transmits the remaining colors of the spectrum. A magenta absorbs in the green region and transmits the rest of the spectrum. Consequently, such a color may be called a minus green. A lemon yellow is a minus blue. Blue is a

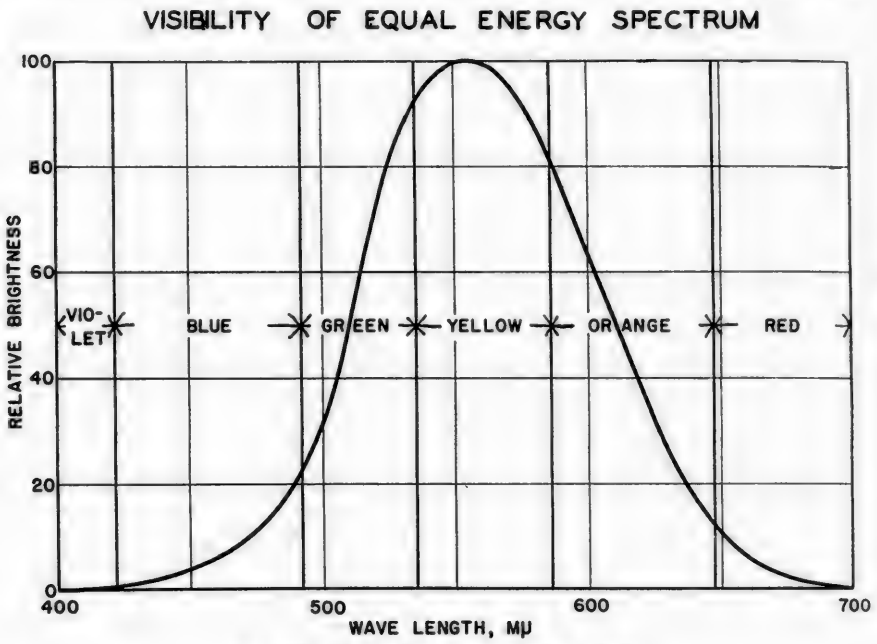

Figure 1. Visibility of spectral colors.

minus orange because most of the light except the orange would be reflected or transmitted to the eye. North sky light contains an excess of blue light and is not a good source of light for microscopy.

By means of colored filters, one can change the appearance of any colored object. If one views a colored object with a filter of the same color, the object becomes light and the detail nearly disappears or may disappear if the filter color and the color of the object match each other. With such lighting the nature of the background may determine whether or not the object will be seen. If, however, on the contrary, the object is viewed through a filter of complimentary color, then the object will appear dark with marked contrast. Complimentary colors are shown opposite each other on the diagram of figure 2. Color filters are of great importance in photomicrography. For instance, if one has a tuberculosis bacterium stained red on a bluish background and this is photographed, it may be that the energies of the light are equal and the photographic

plate would show equal blackening of the red bacterium and the blue background. Thus, contrast would be lost, although to the eye they are distinct because the eye recognizes the difference in color. In order to get this same difference in photographic plate, one may use a color filter to make the bacterium dark on a light background, or a bacterium can be made light on a dark background. In the first case a blue-green filter would be used and in the second case a red filter. To record detail photographically, one uses a filter of about the same color of the object and to obtain a contrast, a filter of complimentary color is used.

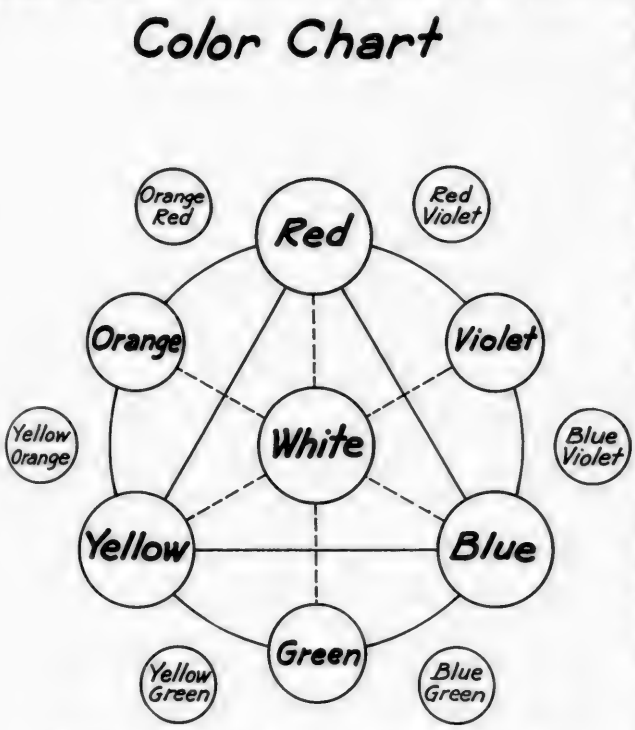

Figure 2. Diagram to show complementary colors.

Color filters change the visual appearance of colored objects and were demonstrated by projecting colors on the screen and then screening the light with different filters. A filter held over a beam of light absorbs certain colors and the colors which are transmitted are colors of the filter. These are called subtractive filters because they absorb or subtract some of the colors. Subtractive processes may be used for getting different colors. For instance, if a magenta, a yellow and a blue-green filter be combined so that all combinations are present and projected onto the screen, the other colors are produced. Kodachrome film reproduces the different natural colors by a subtractive process. The other method of obtaining color is to add together light of different colors. Additive processes are also used in color photography, *e.g.* Autochrome. Agfa and Dufay processes.

Blood is red, consequently an haemacytometer of green glass should give maximum contrast. The theory is correct, but is not realized in practice because the single red blood cell appears nearly colorless when seen under the microscope. The red color of blood is due to the aggregate effect of millions of corpuscles. Consequently, a green filter gives no appreciable contrast with the individual red blood cell.

However, some people prefer green light and to that extent it is helpful. A green filter is useful with achromatic objectives which are corrected primarily for the yellow-green. One sees a little better because the aberrations from red and blue light are lessened by the green filter.

While the green glass does not help in visualizing the individual corpuscles, there is an advantage from cutting the rulings into the surface of green glass. The ruling is seen mainly as a diffraction image and such images show better when viewed with monochromatic light. Consequently, green glass is an approach toward monochromatic green light and does increase the visibility of such rulings. The counting chambers with white lines cut into a grey sputtered metallic coating do not depend on diffraction images of the ruling, and are independent of color effects. Consequently, the green light makes little difference in the visibility of the ruling.

The eyes of different people are not equally sensitive to color. In some individuals the eyes may be blind to a certain color, while in others, color deficiencies occur wherein the individual is not color blind but does have difficulty in recognizing certain colors, especially if the illumination is poor. Only a small region of the retina of the eye is sensitive to color. Consequently, to see colors clearly, the eye must be turned so that the image of what is looked at is focused on this small region of the retina (the fovea). The rest of the retina is sensitive to the white-gray-black and is insensitive to color. If the intensity of the illumination is gradually decreased, the coloredness of colored objects disappears and they appear gray to black. In dealing with color, we must bear in mind problems of illumination and also the varying sensitivity to the eye.

About 2 per cent of men are color blind. Occasionally color blindness occurs in women but this is relatively rare because of the hereditary nature of this defect. Many more people are partly color blind or have color deficiencies. For example, a piece of glass was shown to a number of people. To a few it appeared as a gray having no effect on color. To others it appeared bluish, greenish or purplish. The color was viewed against white clouds so that the observing conditions were the same for different observers. Therefore, the results were due to the differences in

the color vision of the several observers.

Consequently, in dealing with color problems one must bear in mind and evaluate the sensitivity of the people concerned. In fact, only after a person has his color vision tested and knows exactly how normal it is should he set himself up as a judge of color. Persons deficient in green are normally able to see more red than others with normal vision and thus have a certain compensation.

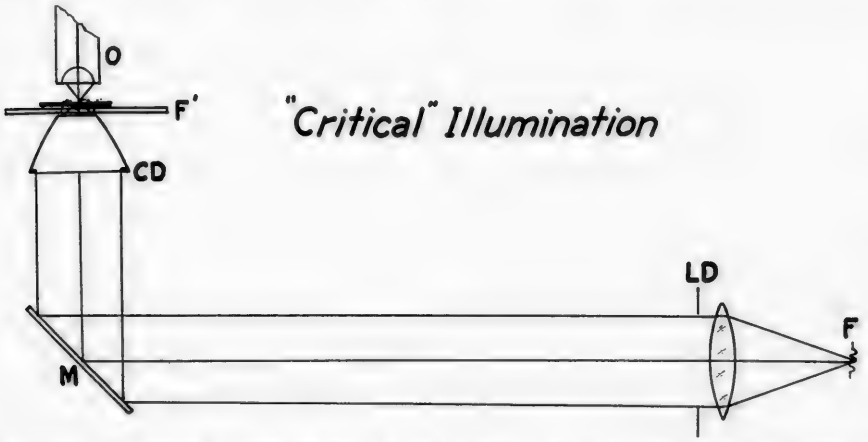

Figure 3. "Critical illumination" for the microscope. O, objective; CD, microscope condenser diaphragm; m, mirror; LD, lamp diaphragm; F, filament and F¹, image of F.

II. Illuminants for the microscope may be divided into two types. The first type consists of a lamp with an illuminated surface, usually a ground glass. The surface should be illuminated evenly by the bulb. This surface then furnishes the light reflected by the mirror into the microscope. Little adjustment of this type lamp is required. If the mirror is turned until the field is evenly illuminated, and then if one removes the ocular and looks down on the back lens of the objective, the condenser should be focused so that the back lens is uniformly filled with light. When both of these conditions are achieved, that is all the adjustment that can be done except that the diaphragm of the condenser should be opened until the back lens is just filled with light.

For the high school type of microscope which has no condenser, the concave mirror is frequently used and the lamp should be moved to and from the microscope until the light is concentrated on the specimen. The easiest way to do this is to hold a pencil point on the surface of the lamp and then move the lamp until the image of the pencil is seen with the specimen under the microscope.

The second type of lamp has a condensing lens system mounted on the lamp which is used to focus the light from the lamp to the microscope. Lamps of this type are focused by moving the lens or by moving the lamp bulb.

In general, such lamps are used in either of two ways. Critical illumination was used in former days when a white cloud or the oil lamp flame served as sources of light. The image of the lamp flame was focused so that it appeared in the field of the object to be examined, figure 3. Parallel light passes from the lamp to the condenser and the light source is focused onto the object.

The disadvantage of critical illumination was that the field was limited to the size of the source of illumination such as the lamp flame. Also the field might not be evenly illuminated. This was particularly true when the oil flame was replaced by the electric coiled filament lamp which gives only a narrow region of illumination when it is focused on the specimen. To avoid this difficulty Köhler devised a type of illumination which bears his name and is illustrated in figure 4. Köhler illumination is obtained by focusing the condensing lens on the lamp so that the image of the filament of the lamp is formed on the iris diaphragm of the microscope condenser. To accomplish this, any ground

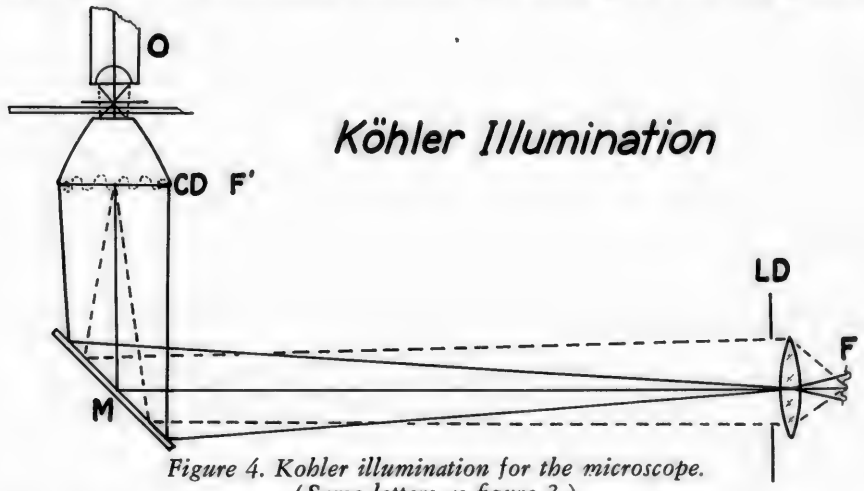

Figure 4. Kohler illumination for the microscope.
(Same letters as figure 3.)

glass must be removed from the lamp system. The condenser is then focused so that the image of the iris diaphragm on the lamp house is in focus with the specimen and the diaphragm opened until only the field of view is illuminated. The diaphragm on the lamp house is called a field stop and is very important because it restricts the lighted area to that

actually used, thus eliminating glare which is fatiguing to the eye and fogs the photographic plate. The iris diaphragm of the microscope condenser is opened until the back lens is just filled with light. It will be observed when the ocular is moved that there is an image of the filament in the back lens of the objective.

Visibility of an object depends on sufficient light reaching the eye. This is not entirely a matter of the amount or intensity of the light, but also involves problems of color, contrast and the varied types of images. Space does not permit this paper to go into these although they are of great importance. The visual or photographic brightness depends on the brightness of the lamp and is directly proportional to the square of the numerical aperture and inversely proportional to the square of the magnification. Different lamps are not equally bright and the details are given by Estey.[1]

The ideal lamp would fill the field of the lowest power objective, the aperture of the highest power lens and be controllable so that the intensity could be adjusted for clearest vision without any glare. For very low power lenses like the 32 mm. focal length, it may be necessary to remove the top lens of the condenser. When the lamp does not fill the field of an objective, there are two other means used to accomplish filling the field. One is to lower the condenser. If this is done the field is filled, but if one removes the ocular and looks at the back lens, one finds that the aperture has been reduced. The other method is to move the lens on the lamp house nearer the filament. This does not affect the aperture so much and does give a little more evenly filled back lens aperture. As objectives of higher numerical aperture are used, the condenser diaphragm must be opened, and the lamp diaphragm is closed because these lenses have smaller fields. A study of figure 4 shows the rays which determine the aperture and the rays which determine the field so that these relations are clear. In order to obtain full resolution, it is necessary that the microscope condenser diaphragm be opened so that the back lens of the objective is filled to full aperture.

There is an exception to the last statement and that is with very transparent material like living tissue culture cells. If one has the diaphragm of the microscope condenser adequately open, it is not possible to see these nearly transparent cells. The diaphragm should be closed sufficiently to gain contrast. The contrast image is seen as a refraction image, but with this lessened aperture full resolution is im-

[1] Estey, R. S. Incandescent Lamp Characteristics from the Photographer's Viewpoint. *J. Biol. Photo. Assn.* 9:18-29, *Sept.* 1940.

possible. The only way that the resolution can be increased is to increase contrast by mounting the material in a medium of different refractive index or by staining it to give a colored image.

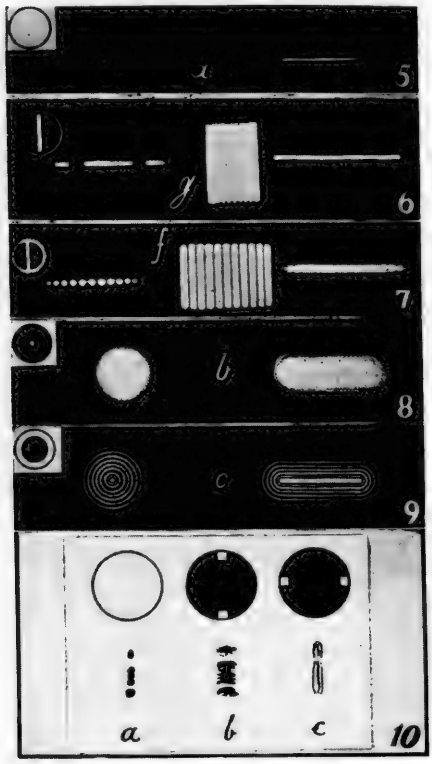

Figure 5. Upper left shows back lens of objective evenly and fully illuminated (N.A. 0.65). The image of a point of light is a bright disc surrounded by a few faint rings and the line appears as a line. From Beck.
Figure 6. The appearance corresponding to figure 5 where only a central strip of the aperture is illuminated. From Beck.
Figure 7. Similar to figure 6 with an annular ring of illumination as well as the strip. From Beck.
Figure 8. The effect of stopping the aperture to N.A. 0.08. From Beck.
Figure 9. Appearance when center part of objective back lens is not illuminated. From Beck.
Figure 10. Appearance of 4 micrococci when the back lens is full illuminated and when stops as shown are placed over the back lens. From Beck.

The practical importance of some of these rules may now be considered. The advantages of using a field stop to limit the illumination to the object actually examined are the reduction of glare and better vision or clearer photographs. The effect of the aperture on resolution is not so readily understood. If one looks at a diatom which has small markings barely visible, with a N.A. 1.30 or an N.A. 1.40 oil immersion lens and then closes the diaphragm of the microscope condenser, the details will disappear. This can be shown also with fine rulings like those made by Grayson.

It is important that the aperture of the lens, as seen on the back lens with the ocular removed, be as evenly illuminated as possible. If this is not evenly illuminated one does not get a true picture of the object examined. The differences are shown by some of the figures from Beck's book.[2] If only a strip through the center of the objective is illuminated, e.g. a ribbon filament lamp incorrectly used, or with an inadequate condensing system, the image of a clear dot and line in figure 5 appear as shown in figure 6. The dot now looks like a series of bars and the line will be thin if in one direction at right angles to the beam of

[2] Beck, C. The Microscope, Theory and Practice. 1938. London. 234pp. Figs. 5-10 are reprinted here with the kind permission of Mr. Conrad Beck.

light, and very thick if in the complementary position. If the condenser is poorly focused so that there is a little light around the rim as well as across the center, then the dot has a repeated pattern as in figure 7, and the line is a smear in one direction or a series of repeated fence posts in the other. If half of the aperture is illuminated, the appearance of the dot is no longer correct and the appearance of the line will depend on its position with respect to illumination. This is why the oblique light is dangerous and requires very careful interpretation. Small apertures and incorrect focusing of the condenser give patterns shown in figures 8 and 9.

The effects become important when the limit of resolution of the lens is approached. Figure 10 shows the effect of a full aperture on four small round bacteria and demonstrates what happens if oblique light is used so that the back lens of the objective is illuminated as shown in the upper circles of the figure. Some of the weird forms discovered when microscopes were first used and not seen since, are undoubtdly due to spurious images from poor lighting of the microscopes.

The measurement of the efficiency of microscope illumination is difficult and requires special instruments. A useful measurement of the light from a lamp is obtained by placing a photoelectric cell in place of the ocular and measuring the light with the illuminant set up under strictly controlled conditions. Unless the photoelectric cell is corrected with a filter to have about the same intensity range as that of the eye, figure 1, the measurements must be interpreted in terms of its sensitivity.

It is usually not possible to measure the efficiency of illuminants by placing a foot candle meter of photoelectric cell on the stage of the microscope because this picks up light which spreads out from the upper part of the condenser, especially when the top element of the condenser projects much beyond the metal mounting. Much of this light cannot enter the objective and is useless as far as illuminating the microscope is concerned. It is not fair to compare microscope lamps by looking down a microscope lighted with one lamp and then shifting to another, because changes occur in dark adaptation of the eye. The unaided eye is not a good measurement instrument; laboratory instruments should be used instead.

A lamp which is adequate for dark field illumination will be too bright for bright field visual illumination. With dark field, the smallest particles seen depends on the intensity of the lamp. The particles appear self-luminous and may be seen even though not resolved.

When the light is too intense the eye cannot see well because too much of the purplish pigment in the retina is bleached. The light should

not be reduced by closing the diaphragm on the lamp because that decreases the amount of the field illuminated when the lamp is properly in focus. Likewise, if the diaphragm on the microscope condenser is closed, the aperture of the lens and the resolution are decreased. Lowering the voltage by a resistance is useful only over small ranges, otherwise the color temperature of the lamp is changed. The alternative for reducing the light to comfortable visual values is to insert neutral density filters or other means of control between the lamp and microscope. Neutral density filters afford the simplest means, and it is possible to bring the light to proper value by use of one or more filters.

The lamps emit light too yellow to give the appearance of daylight. Problems in color temperature are dealt with in Dr. Estey's paper.[1] It might be pointed out that a suitable filter to change the color of one of these lamps to daylight cannot give more than one kind of daylight. Sometimes we have requests for a brighter or a darker filter. If more or less yellow in the light is preferred, then special blue filters have to be used.

BOOK REVIEWS

THE YEAR'S PHOTOGRAPHY, 1940-1941. ***Royal Photographic Society Publication, London. Price: Two Shillings and Sixpence.***

This volume clearly indicates that photography is a living art, for during the first year of the present world catastrophe that high technical quality so characteristic of this Annual is more than apparent. There are 50 reproductions of a pleasing variety of subjects, presented in excellent half-tone. It is interesting to note, that there is a singular absence of reproductions of pictures that in any way reflect a war-time atmosphere.

F. J. Mortimer, F.R.P.S., F.R.S.A., President of the Society, contributes a commentary on the illustrations and on the exhibition in general; G. E. W. Herbert reviews the Exhibition of Lantern Slides, Oliver G. Pike, F.R.P.S., F.I.B.P. writes on the exhibits in the Nature Section.

The high standard maintained in this volume again warrants congratulations to the British workers for a fine Annual.

AN ATLAS OF THE FROG. ***Paul L. Carroll, S.J., Ph.D., and Wilfred F. Horner, M.S. The C. V. Mosby Company, St. Louis. 109 pages, looseleaf, with diagrams.*** **$1.25.**

This atlas provides information on several species of the genus Rand. The diagrams were drawn from freshly killed and well-preserved specimens, all the parts of the frog being clearly labelled. Blank pages opposite the diagram provide space for notes. Hence this atlas serves as an excellent laboratory manual for the student. It will also serve as a source for quick review for anyone working with the frog.

The loose-leaf sheets are punched to fit standard two and three-ring binders.

Proctosigmoidoscopic Cinematography in Kodachrome*

by J. D. Brubaker†

As a result of the development of the equipment presented herein for taking 16mm motion pictures in Kodachrome, teachers of medicine are now able to project films which portray the appearance of the bowel as seen during routine proctoscopy. The various pathologic conditions found during the examination can thus be photographed and the films used to instruct those who do not otherwise have opportunity for proctoscopic observation. This is particularly valuable to those who do not expect to specialize in proctology but who want to know something about it.

The equipment once adjusted, maintains its adjustment of focus, no attention being required other than to observe through the telescope, change the film magazines, and wind the camera.

The instrument is held by means of a substantial handle, in the right hand, the left hand being used to steady the proctoscope. With care on the part of the operator there is no added risk to the patient.

Ordinarily at least one assistant is required. He hands the instrument to the proctologist and closes the attaching clamp. During filming he operates the camera and raises the voltage on the lamp by means of a portable switch.

One of the first problems presenting itself in the design of the instrument was how to get sufficient light down the proctoscope. Another important feature was how to arrange the equipment so that the bowel could be observed continuously while taking pictures. A telescope was arranged so that the field being photographed could be seen at all times during the filming process, thus avoiding blind manipulation.

The individual problems might not be so difficult, but it required considerable study to combine three optical systems (light, telescope, and camera lens) in the same narrow cylindrical space.

The light source chosen is a standard 108 watt 6 volt 18 ampere tungsten ribbon filament lamp[1] of the type used in photomicrography and microscope illuminating units.

The lamp is operated from a special transformer designed with taps

* Presented at the Annual Convention of the Biological Photographic Association in Milwaukee, September 13, 1940.

† Photographic Engineer, 805 Greenleaf St., Evanston, Ill.

[1] Hardy and Perrin, Principles of Optics, p. 171, McGraw-Hill 1932.

on the primary to allow a quick shift in voltage on the lamp. This is shown in figure 2. The lamp is operated at 6 volts for examination of the field to be photographed. When the proper position of the procto-

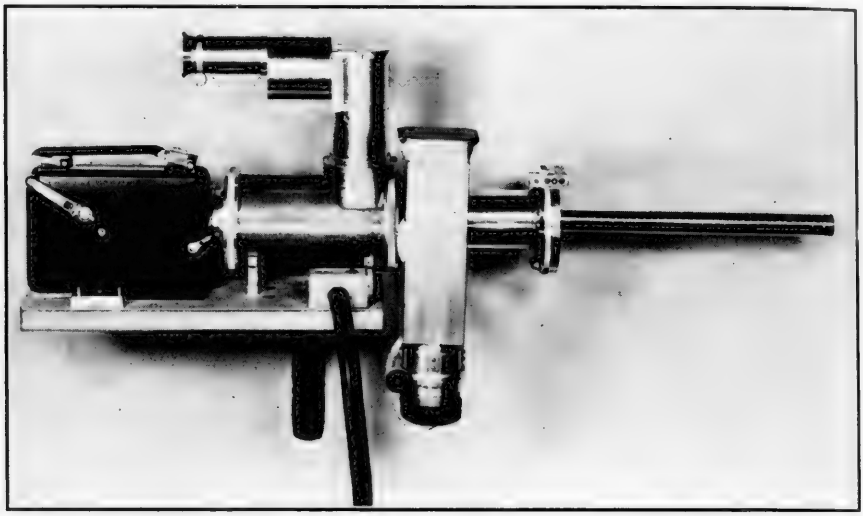

Figure 1

scope in the bowel is reached, the lamp is switched to a higher voltage (7½ volts) and the camera started. When the camera is stopped, the lamp is again reduced to 6 volts to conserve its life. The 7 foot number 10 flexible cable produces a voltage drop of about ½ volt in the cable, requiring a transformer voltage of 6½ and 8 volts respectively for the low and high positions of the control switch. Adjustable taps are also provided on the primary of the transformer to compensate for variations in the average line voltage found in different localities.

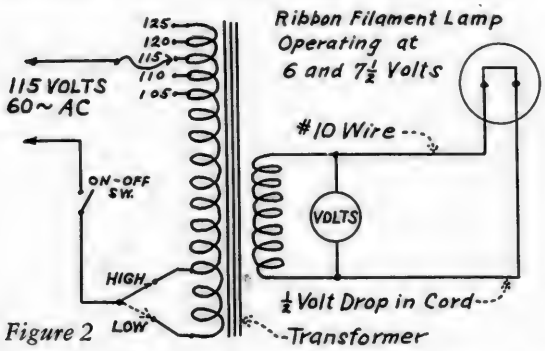

Figure 2

The lamp manufacturers state that when operating at 7½ volts, the expected life of the ribbon filament lamp is on the order of 2 hours, figure 3. The color temperature at 7½ volts is about 3200 degrees Kelvin, figure 4. (By operating the lamp at about

8 volts with a life of one hour, a color temperature of about 3300 can be obtained). The proper color temperature for Type A Kodachrome

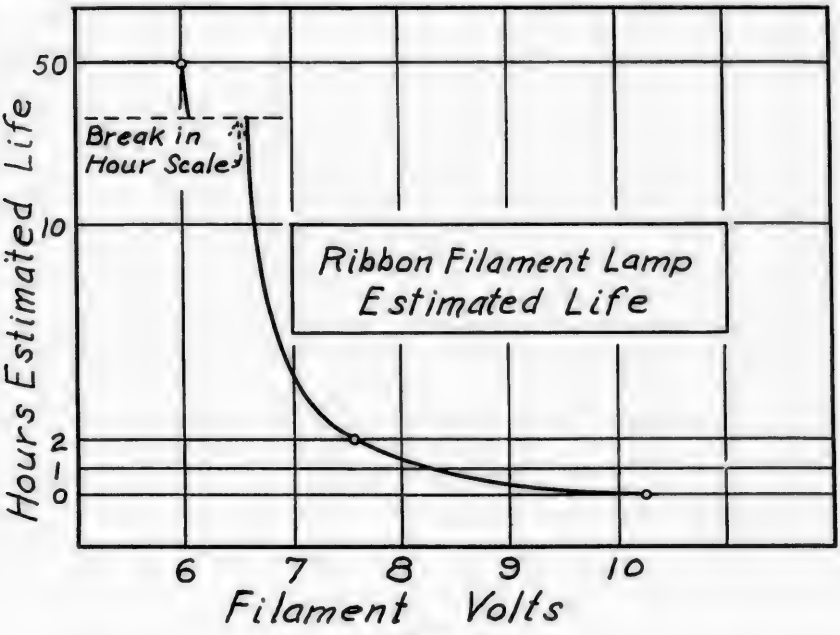

Figure 3

is 3450. As a result of our experience, the difference in color temperature is not serious and is not apparent to the average person. A difference of perhaps 150 to 200 degrees is the smallest amount ordinarily noticeable.

The average illumination is adjusted to be correct either when the bowel is partially collapsed around the end of the proctoscope or when the bowel wall is somewhat stretched across the end of the instrument. Both of these conditions require the same illumination. Reflections of the light source produced by the moist mucosa are not troublesome provided ordinary care is used to keep the wall of the bowel from coming directly across the end at 90 degrees to the axis of the proctoscope.

This may sound like it is difficult to maintain the illumination at a proper level, but it is not. Under average conditions the pictures are taken with no special regard for the position of the bowel wall, concentrating primarily on showing the landmarks and detail as they appear in the observing telescope.

Occasionally the reflection of the light source from the wall surface

is used to show the granular appearance present in certain pathologic conditions.

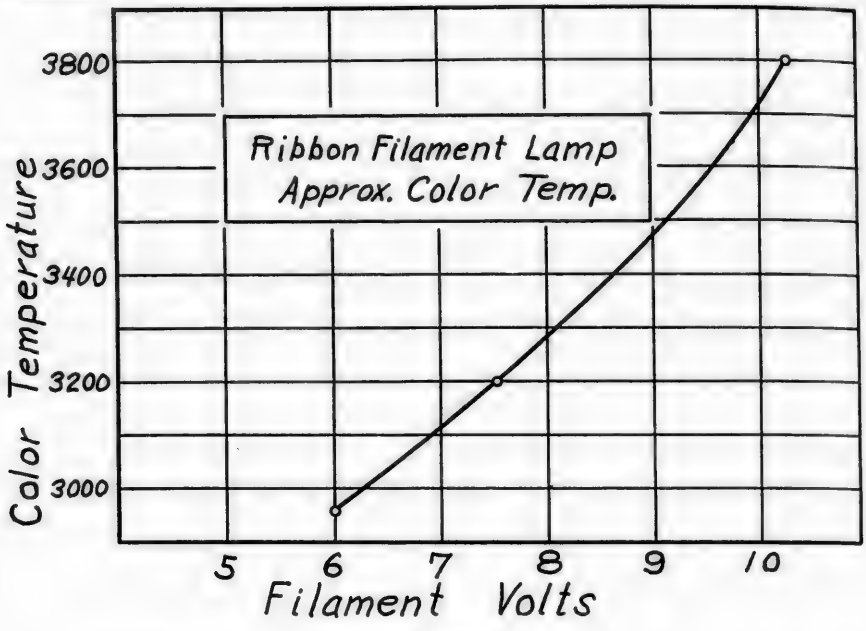

Figure 4

Although the calculated life of the lamp at 7½ volts is only 2 hours, we have found by trial that the average life is probably a little longer. The exact life should not matter from the standpoint of cost since this expense is only a small part of the cost of film taken during the life of a lamp. For reference, it is interesting to note that the normal life is 50 hours at 6 volts, the rated voltage of the lamp.

The useful portion of the ribbon filament is about 2mm wide and 7mm long. The center portion of this ribbon is focused by a condenser on a plane just beyond the distal end of the proctoscope in the approximate position of the object. A front surface mirror (prism) directs the light down the tube.

This method of illumination allows lamps to be replaced without changing the light value on the field photographed.

In the present instrument, illumination levels of 130 foot-candles, Weston, are obtained, figure 5. This level of illumination corresponds to the reading obtained from the normal arrow of the Weston meter when measuring an equal intensity of light reflected from a medium gray surface.

The only lens used in conjunction with the movie camera is a Leica 90mm focus Elmar f:4 in a focusing mount. The illumination level of 130 foot-candles would require a stop of f:8 with the lens focused for in-

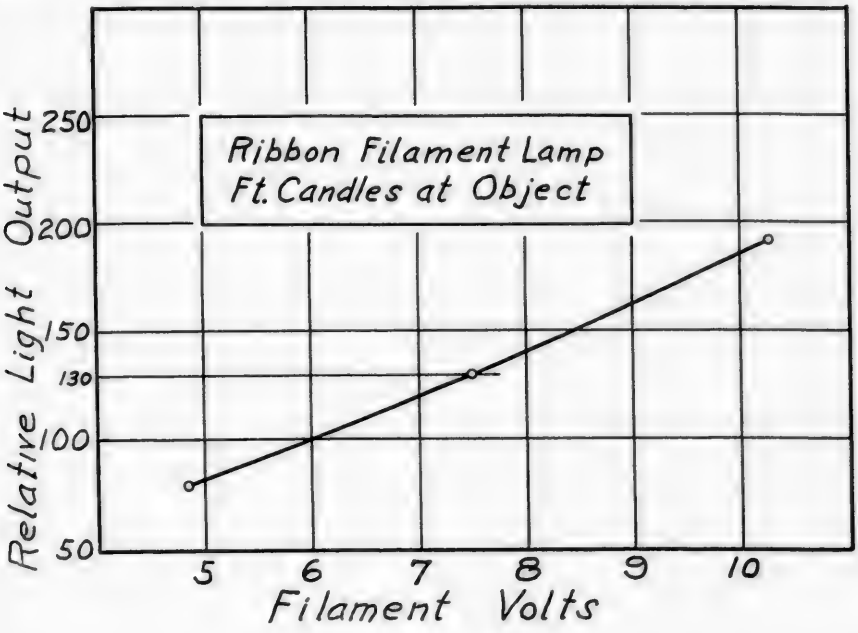

Figure 5

finity. Due to the extension of the lens and obstruction of the illuminating prism in the field of view, the stop used as actually marked on the lens is about f:5 at 16 frames per second and a shutter speed of 1/34 of a second.

The lens is mounted with a gear and pinion, figure 8, so that the lens can be focused by a knob on the outside of the instrument case, using a ground-glass visual focusing device in the magazine movie camera. When the correct focus is obtained, the adujstment is locked by a set-screw by means of a split sleeve clamp on the adjusting shaft.

The telescope is designed so that the eyepiece will be in a comfortable viewing position about 6 inches above the center-line of the proctoscope. A prismatic erecting system is included in the optical path so that the field observed will be erect and correct from side to side exactly as normally viewed when looking into a proctoscope.

The telescope has a magnifying power of about 6 times. In other words, the far end of the proctoscope is brought to an apparent position

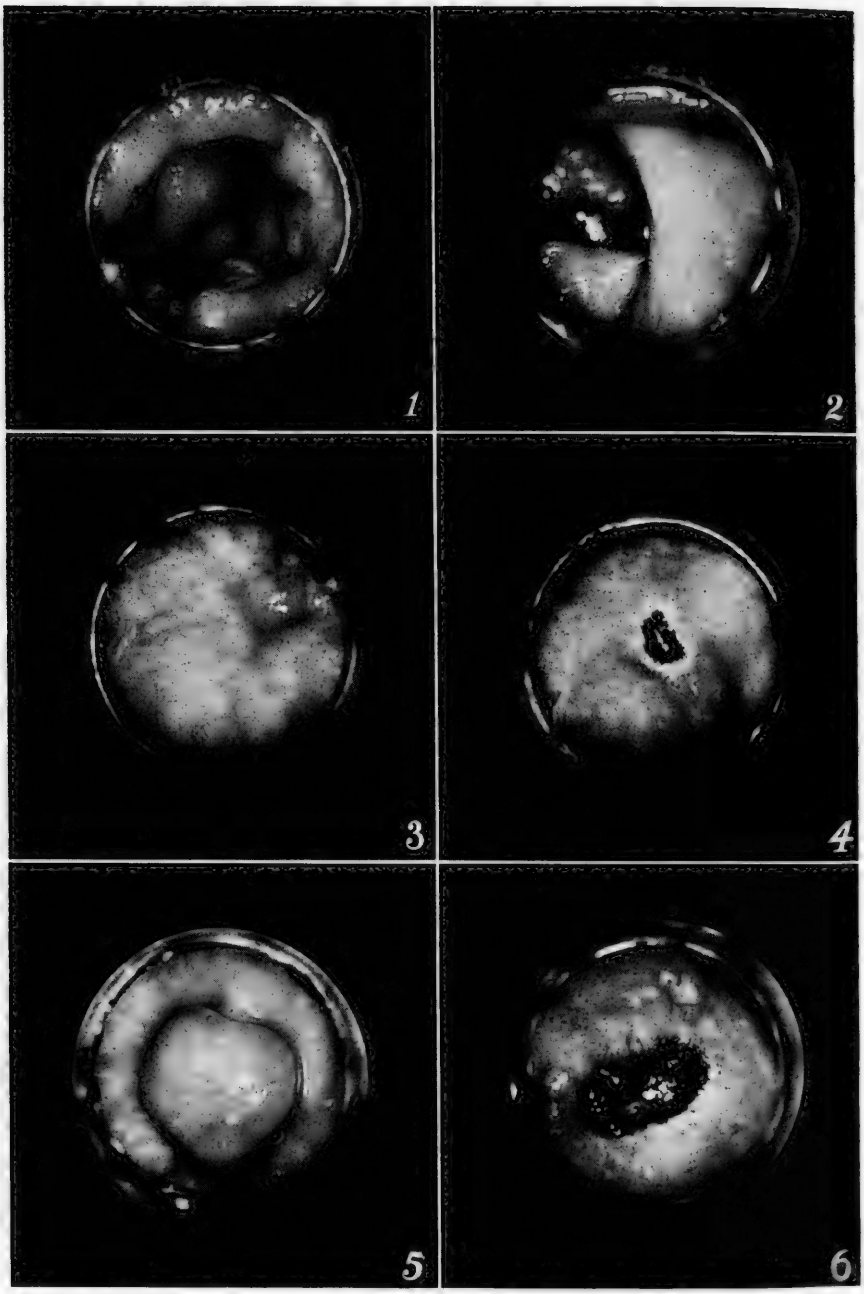

Figure 6

Black and white reproductions from 35 mm. Kodachrome transparencies. (1½ times life size.) (1) Mucosal folds in the normal sigmoid. (2) Rectal valves. (3) Sessile polyp. (4) Sessile polyp after fulgeration. (5) Pedunculated polyp. (6) Pedunculated polyp after fulgeration.

about 2 inches in front of the eye. This choice of magnifying power is high enough to allow using the telescope for focusing the instrument while taking the pictures, and yet not so high as to prevent the operator from seeing a general view of the field as it will appear in the finished 16mm motion picture film. The depth of focus in the telescope is shallow enough to provide accurate focusing for the camera. The accommodation of the eye causes no trouble in this design.

The telescope and camera are both focused on a point about ½ inch beyond the end of the proctoscope. Thus when the field is seen sharply in the telescope, the picture will be sharp on the film. It so happens that the depth of focus in the telescope is roughly the same as that of the camera with the happy result that the finished picture will have nearly the same appearance as seen through the telescope.

The actual depth of focus of the critically sharp image at the object is about plus or minus ¼ inch. That is, all parts of the bowel wall which lie ¼ to ¾ inch beyond the end of the proctoscope will be in sharp focus. This assumes a maximum circle of confusion on the film of .004 inch. The resolving power of the lens is a circle of about .001 inch. The resolving power of Kodachrome is approximately .001 or .002 inch. Although the distant portions of the bowel wall beyond one inch are out of focus, this causes no confusion when the film is projected.

The image of the end of a ¾ inch proctoscope, on the film, is about 0.150 inch in diameter. (Both ¾ and ⅝ inch size proctoscopes are used). The area of the 16mm film frame seen on the screen in 0.284 inch high by 0.380 wide. Thus the circular image is large enough to show fine detail in pathologic conditions such as chronic ulcerative colitis, one of the most difficult to photograph.

An important feature of the instrument is a clamp specially designed to attach or detach the proctoscope quickly. The proctoscope is first introduced in a normal manner and the obturator withdrawn. The proctoscope is then inserted to the maximum distance desired and residual fluids removed by suction. At this point the instrument is attached and the pictures taken while withdrawing the proctoscope under direct vision by means of the telescope.

An optically flat glass disc inclined at an angle was used for an air seal to allow distention of the bowel with air inflation, but proved in most cases to be unnecessary. Later the disc was removed entirely.

All 16mm magazine cameras of the recent automatic loading type such as Cine Kodak Magazine, Bell and Howell 141, and Bell and Howell Auto Load, run for only about 12 feet on one winding. A motor driven camera is now being built so that a full 50 foot roll of magazine

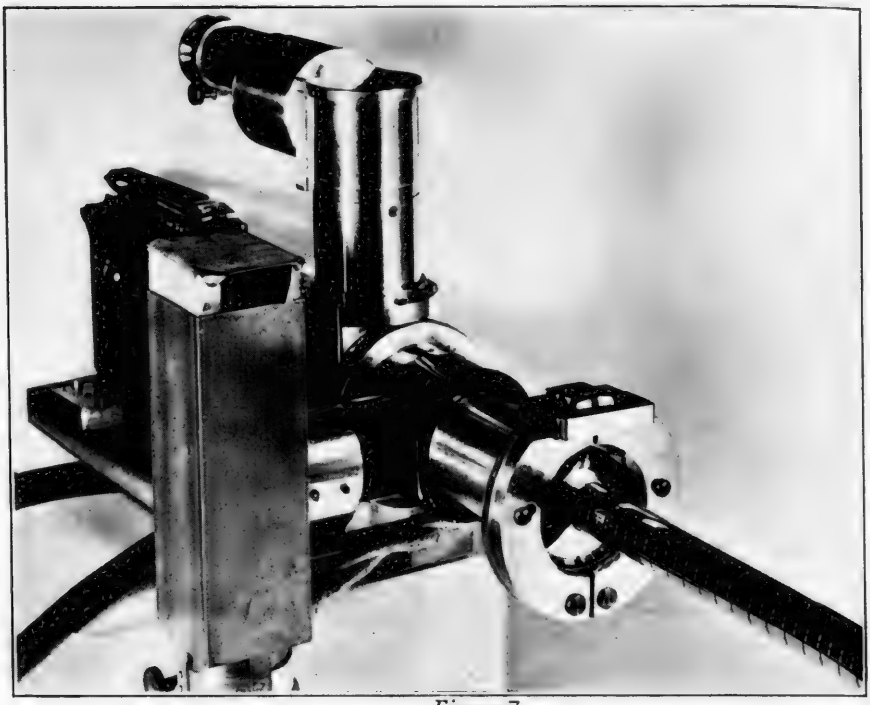

Figure 7

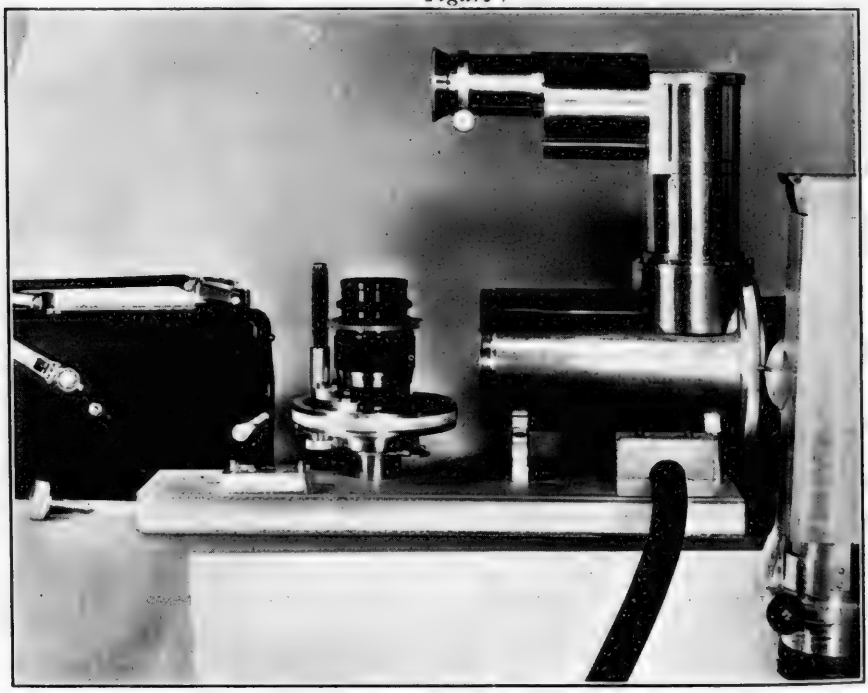

Figure 8

type film can be run without winding of the camera.

On the new model the motor drive, camera, and lamp all will be interlocked with one control lever so that the lamp voltage will be raised and the motor started when the camera release is operated. This will avoid any possibility of taking pictures with the lamp at low voltage with consequent under-exposure and low color temperature operation.

The equipment is carried in two cases. The transformer, voltmeter for the lamp, and connecting cables in one case; and the instrument proper with its accessories in a larger case. When the case is closed, it holds the instrument firmly in place, allowing its transportation like baggage.

Since it is not possible to enlarge a single frame of 16mm Kodachrome to show adequately the appearance of the film on the screen, I have copied in black and white, figure 6, some Kodachrome 35mm still transparencies taken with a new proctoscopic still camera now under development in which a flash bulb is used. These illustrations represent fairly well the detail seen through the telescope and on the screen. Of course all the delicate shadings due to color are lost in black and white. The original transparencies are 0.55 inch in diameter (0.7 life size).

The author is greatly indebted to Dr. Jay M. Garner for whom the equipment was designed and built, and also to Dr. J. P. Nesselrod in whose clinic the first pictures were taken and who gave many valuable suggestions toward improving the design of the instrument. The equipment described is in fact a collaboration of Dr. Garner, Dr. Nesselrod and myself.

Our Retiring President

BORN in Baltimore, April 21, 1866. . . . Attended public schools and studied art with a well-known portrait painter. Became an apprentice to a lithographic artist and took an active interest in photo-engraving when first introduced. Developed into an artist and etcher of note. . . . Worked in the laboratories of the Johns Hopkins Medical School. . . . Was selected to make the microscopic drawings for the first American Anatomy by Dr. George M. Piersol of the University of Pennsylvania. . . . Worked for Dr. Simon Flexner, who later selected him to organize the Illustration Division of the Rockefeller Institute for Medical Research. . . . Has trained many biological photographers. . . . Assisted Mr. Ralph Creer in organizing the B.P.A., became a charter member and one of the first directors. . . . Elected Vice-President of the B.P.A. in 1933. . . . Elected President in 1934. . . . Presented with a life membership in 1938. . . . Served as President from 1934-1940. WELL DONE GOOD AND FAITHFUL SERVANT

Louis Schmidt

Our New President

BORN in Sweden but is a naturalized citizen. . . . Spent most of his life in Minnesota attending schools in that state. . . . Became interested in photography as a hobby in 1918 and in a short time decided to make it his vocation. . . . Served apprenticeship in a photographic studio in 1921. . . . Worked in several commercial and portrait studios but his interest was always in scientific fields. . . . Began work at the Mayo Clinic early in 1928. . . . In 1929 was made head of the photographic department in which capacity he is now serving the Mayo Clinic. . . . Has filmed some 700 surgical procedures. . . . Joined the B.P.A. in 1933. . . . Has been a director and vice-president. . . . Elected president in September 1940. . . . MAY YOUR TENURE IN OFFICE BE PLEASANT AND MAY THE ASSOCIATION PROSPER UNDER YOUR GUIDANCE.

Leonard Julin

CHATS WITH THE EDITOR

Photography and Clinicians

by Carroll B. Larson, M. D.*

WHILE the laity has been developing photography as a hobby, clinical photographers have been quietly adapting photography to use in medicine and have reached the point where their pictures now add a precious seeing to the eyes of the medical profession. Photographs have been injected into the regular routine of hospitals so inconspicuously that doctors accept them as a matter of course and fail to realize the tedious effort spent in the production of such an indispensable adjunct to modern medicine. Conversely, photographers fail to realize their importance to the medical profession in lieu of their own eagerness to technically perfect clinical photography. It is my hope that you as photographers will cast aside your technical eagerness long enough to read this simple passage, to regain a view of the objectives from a clinician's standpoint.

You have given us clinicians a long list of available forms in which the darkroom is the center of activity. These include black and white and colored photographs, infra reds, phantoms, reduced x-rays, photomicrographs, slides, screened prints, movies, etc. Each of these in turn can be adapted so that the possibilities for adaptation becomes unlimited. The unlimited sphere we leave to you as your own playground, and return to the adaptations which are in common use at present.

It is fast becoming recognized that without clinical photographs, records cannot be complete. This is obviously true only when there is something to be photographically recorded, such as deformity. Photographs under these circumstances will more completely record the findings than any amount of verbal description. It is therefore necessary that the photographer know exactly what the clinician wishes to portray. This is, in case of doubt, most sensibly achieved by "Talking it over," so that at the same time the technical difficulties may be aired. The lack of this direct contact accounts for most of the disappointments; therefore,

* Received for publication July 19, 1940. 264 Beacon Street, Boston, Mass.

close cooperation is urged as the only solution for a happy outcome. As a matter of fact, clinicians are more likely to lose sight of this, so that it may become necessary for photographers to gain this contact by insistence.

The photographs made for records can be used subsequently in many ways, such as case presentations at medical discussions, teaching collections, exhibits, publications, and so on. Because of this varied use accuracy is an absolute requirement. Most photographers are aware that photographs can lie, and this abuse can be avoided simply by keeping it in mind. For example, observe an equinus foot. This can be made to appear normal if the shadows are so arranged that the heel appears to be flat on the standing surface. Another pitfall is the reversing of negatives in printing. This, of course, is an unintentional error, but it has been known to happen, and the effects were embarrassing to clinician and photographer alike.

Those who are interested in photography always have an eye out for opportunities to photograph those things which fit their interests, such as completing, for example, a group of muscle contours, or recording permanently an unusual traction, or the like. Along the same line, photographers should keep in mind the follow-up photographs in order to have available the pre and post treatment pictures. This refers as well to short movie shots which lie about uncompleted. The completion of the photographic record, whether in stills or movies, should be the responsibility of the clinician, but many times the interest of the clinician will be rekindled by the alert photographer who reminds him of what should be completed.

This leads to another point worth mentioning, the maintenance of files. Actually, this cannot be classed as a requisite to photography, but any wide-awake photographer goes beyond what is required and keeps adequate files. Such files have been of inestimable value to clinicians as a supplement and short cut to ordinary hospital files, probably because they are less cluttered, more easily available, and cases are many times remembered by their photographs. These files should be cross indexed by name and diagnosis, and to accomplish this the necessary information should be obtained on the requisition.

It is common for requisition slips to be signed "routine views," and in the hustle and bustle of getting to something seemingly more important, the routine will serve as the excuse for leaving out a more to the point view. Even routines can be made more helpful by such simple things as the marking of landmarks with black crayon and the use of contrasting backgrounds where outline is needed.

To escape the humdrum of routine stills, the photographer may take

to movies. The horizon of applicability is usually limited by resources. However, such occasions as operations or the study of gaits can be recorded through no better medium. Here the photographer's technical ingenuity is taxed, but what should be just as important is often forgotten until the "take" is over. I allude now to the poor direction of the scenario. When it comes to acting, very few physicians or patients are of Hollywood timber. It therefore behooves the photographer to act as director. The direction may consist of nothing more than advising the surgeon to clear the operative field of hands and instruments, or giving a patient a trial run on a gait. Even in educational takes such little things as a change in setting, mixture of long range and close ups, or the addition of an irrelevant smile will greatly increase the attention of the audience. These simple details, when anticipated, may avoid a great deal of later confusion and give the polish which is too often lacking.

In conclusion, I wish to express my admiration for photographers who have given clinicians a concise and refreshing method of recording observations. I feel strongly that the only way to improve our photographic records is to achieve closer cooperation between photographer and clinician. In this way the photographer will be aware of what the clinician wants and the clinician will realize the technical limitations. Future photography will be of ever increasing value to the clinician, and this in itself will be a monument to clinical photographers.

Photography for Dentists

The members of the Study Club of the Chicago Dental Society are evidently an enterprising group. The Study Club offers them a course in public speaking and this year is making available to them, for the first time, another course of great value not only in connection with their public speaking but with their office procedure, records, etc. This is a series of eleven lectures on photography, given by our member and director, Mr. Ralph Creer of the Veterans' Facility, Hines, Illinois. Mr. Creer will discuss the following subjects: The value and application of photography to dentistry; the choice of camera, lens, tripod, lighting equipment and proper photographic material; the photography of patients; motion picture photography of dental subjects; color photography as applied to dentistry; photography of models and appliances; making reproductions from x-ray films; preparation of lantern slides; dark-room technic; preparation of exhibit material, and the preparation and arrangement of prints for publication.

The Onward March of Biological Photography

by Wm. L. M. Martinsen

A STUDY of a total of 127 returns to a questionnaire which was recently submitted to the members of the Biological Photographic Association, discloses many interesting facts. These returns came from 90 medical and 37 non-medical photographic departments (the latter mostly from the biological sciences).

The report that 56.7 per cent of the departments reporting were organized during the decade which is just ending (1931-1940), is both interesting and unexpected. These were the depression years, yet we find that more than half of the departments reporting were organized during that period and only 43.3 per cent during all the years prior to 1931. (The earliest reported was 1897.) This increase is evenly distributed over the decade, 27.5 per cent being added during the last five years. One department was reported as being dissolved, but as there are other photographic departments in the same institution, its duties were undoubtedly transferred to them.

The survey further shows that 41 per cent operate on a full time basis and 59 per cent on a part time schedule. The latter departments devote on the average about 28 per cent of their time to photography and appear slightly more numerous among the non-medical sciences.

The volume of work has increased roughly 135 per cent (average) according to the reports from 81 per cent of the departments, while 4% report a decrease, 15% made no report.

A study of the employment record for the last five years of 104 departments reveals a 100 per cent increase in the personnel in 29, while only 3 report a decrease. In addition, 31 new departments were established during this same period and their entire personnel may be added to those engaged during this five year period. Allowing for all factors, the figures show a total increase of 95 per cent in employment.

A further breakdown of the figures shows the *over-all average* number of employees per department to be 1.4, while if the full time departments only are considered the number rises to 2.3 workers.

A total of 80,359.5 square feet of floor space (averaging 730.54 square feet) has been reported by 110 departments. This is an increase of 46 per cent over five years ago. The increase is accounted for

by new departments established as well as a 70 per cent increase in the floor space of 30 older departments. Based on the over-all average employment factor (1.4) the floor space reported is equal to 521.8 square feet per worker.

Inquiries regarding budgets brought only a 50 per cent response, but these reports perhaps constitute a fair cross section of the whole. According to their figures, 64 departments spend a total of $201,365.40 (average $3.146.33) for photography annually. Of this total, about $80,400.00 (or 40 per cent) is spent for materials and equipment, with the remainder going to salaries. Nothing is charged to overhead, which must be borne in mind where comparisons are made with commercial establishments. The budgets as reported represent a 90 per cent (average) increase over that spent by these same departments five years ago.

A total investment in equipment amounting to $341,982.97 is reported in 110 returns, This is an average of $3,108.93. Of this large sum, 95 departments report spending $124,431.00 in the last five years. This shows a gain of about 42 per cent when correction is made for errors due to the discrepancy in the number of reports studied.

In addition to their photographic activities, 24 departments report using x-rays for research purposes (not clinical diagnosis). Non-photographic illustrative materials, such as drawings, mouldings, etc. are reported a part of the duties in 60 departments.

As one studies the figures which emerge from this survey one is im pressed by the singularly large growth that our profession has made in the short span of five years, and the promise it appears to hold for the future. At the same time, a note of warning is sounded by these same figures, which we will do well to heed.

We have found that the volume of work has increased on the average of 135 per cent, and employment about 95 per cent, yet the total floor space has been increased by only 46 per cent. As yet this is not serious, because the average space given to each department (730 square feet) is still sufficient to carry on without loss of efficiency. However, the trend is not a healthy one, but one which merits our most serious consideration.

This is more especially true when we note that 30 new departments which have sprung up during the last five years occupy on the average only 496.5 square feet each, while the employment figure is approximately on a level with the total average. Our society should, therefore, for the good of the profession, make it a part of its mission to advise and direct so that this trend may be corrected.

The President's Address*

by Louis Schmidt†

IT gives me great pleasure to meet you here on the occasion of our Tenth Annual Convention and to report to you the activities of the Association through its agents since our last meeting. There has been no meeting of the Executive Board, the only important decision that required action having been solved by a vote taken by mail.

The Association is now incorporated under the laws of the State of New York, with its legal office in Buffalo. Thus we have completed the plan on which your Committee worked for several years, weighing the advantages and disadvantages which the problem presented, as well as its cost. The principal reason for incorporation is that it protects the member as an individual from responsibility for the acts of the Association as a group. Moreover, it frees him from the danger of being sued for the Association's possible debts. Through one of our Directors, Dr. Oscar W. Richards, the act of incorporation was handled for us by Mr. Walter H. Popp of the legal staff of the Spencer Lens company, and the Association was thus saved the expense of the usual fees; for which we are grateful.

At last year's Convention we acted to take over publication of the *Journal of the Biological Photographic Association*, making the Association responsible for both its Editorial and Business policy, as well as for its financial obligations. Before that time the Association had been in a sort of partnership with its several publishers. This arrangement did not work out to the satisfaction of any of the parties concerned. Mr. Leo C. Massopust, the Editor of the Journal, has consented to assume the Business Management in addition to his other duties. It is certainly a big undertaking for a relatively small Association to give its members a journal of such high quality. Now, more than ever, we should, each one of us, strive to obtain new members, in addition to subscribers and advertisers for the journal. Once the journal is edited, illustrated and in type, the printing of several hundred additional copies would cost very little and the income from the new members would be almost clear profit. Let us determine now that each of us will bring in a new member or subscriber. More Sustaining Members would also be welcome.

* Presented at the Annual Convention of the Biological Photographic Association in Milwaukee, September 12, 1940.

† Rockefeller Institute for Medical Research, New York, N. Y.

The income of the Association is derived from the dues of the members and Sustaining Members, from non-member subscriptions to the journal, from payments for advertisements, from the sale of back numbers and reprints, and from the difference between the income and cost of the Annual Convention. The latter item may be explained as follows. Members attending the Convention pay a registration fee and firms or corporations employing technical exhibits pay for the space they occupy. From these sources are deducted the expenses of the Convention and the balance is added to the treasury of the Association. The expenditures include printing and mailing the journal, stationery and postage, a small amount of typewriting and other incidental office expenses, as well as the cost of transportation of the Salon and Albums to and from exhibition locations. No officer or director receives any pay or allowances.

It is to be noted especially that the Association is just about as old as the depression, in spite of which it has made good progress. Its membership, increasing steadily, if slowly, is very representative and widely distributed. There are members in both the Americas, Europe, Asia, Australia, and Africa. The journal enjoys a world-wide distribution. However, because of the war, the journal has lost two valuable advertisers whom we should make every effort to replace. The income from the two-page space formerly occupied by them represents a substantial amount in the budget. Let it be everybody's business to get them filled.

At the request of the Surgeon General of the Army, the Association has conducted a survey of its personnel to determine the aptitude of its members for assignment to duty in Illustration Units of the Medical Department that may be organized in the event of mobilization. Your President and Mr. Ralph P. Creer, the Chairman of your Committee, have conferred with Colonels Ash and Cornell of the Army Medical Museum and have assurances of their cordial cooperation and approval of the work done. Mr. Wm. L. M. Martinsen, one of your Directors, suggested that a questionnaire be sent to all members, requesting information on many pertinent matters relating to trends in the photographic divisions in which they are employed, covering materials and supplies used, number of staff and increases or decreases in it, quality and type of equipment and work, floor space, etc. Returns from 127 laboratories reveal many interesting facts when compared with the survey of about five years ago. For this reason it appears that a survey at five-year intervals is indicated as a matter of routine. After careful study and comparison the facts will be assembled under the title of "The Onward March of Biological Photography." Both the questionnaires to which reference has been made were mailed to all the members in the same enclosure

which carried the pre-Convention notices, at very slight additional cost.

The Pittsburgh Chapter, under the leadership of our able Secretary, Miss Anne Shiras, has prepared a group of abstracts of the material contained in our journal, intended to make its contents more easily available than by the use of the volume indices. A complete report will follow.

A gratifying interest has been shown by the members and chapters in the Annual Salon. In some cases, those who sponsored the exhibition paid all or part of the transportation charges. The Albums, too, have been in demand. There is a plan afoot to send them to the Pacific coast, with arrangements in advance to route them to a group of interested members and to return them to the East through other members en route, thus serving a large group at small expense.

The war has brought forward another problem: Canada has placed a 10 per cent duty on all foreign magazines and at the present time their currency is off about eleven cents on the dollar. As the journal is published at a loss, it appears that we must raise the dues of the Canadian members and the subscription price of the journal, or absorb a substantial deficit. Several news agencies have advised us that an advance of our subscription rate to $3.75 would not be unreasonable nor out of line with the policy of other publications. On account of these conditions and under pressure from news agencies, about August 1st, 1940, I instructed the Treasurer, Miss Stella Zimmer, to quote a price of $3.75 for Canadian subscriptions, and to bill Canadian members at $3.50 for the year 1940-1941. However, in the event that they had paid dues at the $3.00 rate, the journal would be forwarded and a bill sent requesting the additional $.50, but in no case would the journal be discontinued. This was a temporary arrangement. The matter must be decided either here in open meeting or be referred to the Executive Board.

There has been a gratifying demand for back number volumes and complete sets on the part of public libraries and corporations, indicating that the value of the journal is growing. The stock in some of the numbers is low and we must guard against a recurrence of this in the future. This year we spent $125.00 to reprint fifty copies of Nos. 1 and 2 of Volume VI. This made it possible to complete 11 sets which would sell at $22.00 per set. When these have been sold, we must decide whether we will do further reprinting or admit our inability to furnish complete files.

Almost every year occasions present themselves to your President or Secretary for placing on exhibition or furnishing for illustrated articles photographs that would result in great credit to the individual photographer who furnishes them, as well as to the Association as an organiza-

tion. In order that we may take advantage of such offers, there should be in the hands of some official an ample supply of your best prints, accompanied by permission to use them either for exhibition purposes or for publication, or for both. Usually when such a request is received there is not time to invite members to send in the material. Hence it should be assembled in advance.

An evidence of the growing prestige of the Biological Photographic Association was an invitation to have it represented by a delegate at the American Scientific Congress held in Washington, D. C., under the auspices of the Government of the United States, during the week beginning May 10th. It was attended by delegates from all the countries of the American continent and many visitors as well. Delegates from all the recognized societies of this country and other interested scientists were also present. The meetings were held in groups and all sciences were represented. Addresses were presented in English, Spanish, Portuguese, and French. At the plenary sessions there was an interesting feature. Each listener was provided with a set of head phones which hung on the seat before him. These were furnished with a dial, each point indicating a particular language. By means of this, everyone was enabled to listen to the discourse in his own language. Your President went as your delegate and attended some of the meetings of the Zoologists and those on Medicine and Public Health. He also took advantage of his stay in the Capital to visit the most important photographic laboratories in the Department of Agriculture, where more than 300 photographers are employed. Only a small percentage of these are doing original work. He had a most pleasant session at the Army Medical Museum, both with the officers in charge, Colonels Ash and Cornell, and the chief photographer, Mr. Reeves. Another worth while visit was that made to the new building of the National Medical Council at Bethesda, Maryland, where there is a new and very complete photographic department presided over by Mr. Reed. During the summer a visit was made to Duke University, a truly stupendous institution with all its buildings on a 5,000 acre campus in architectural harmony. They have a very good photographic department, and also, within the School of Medicine, an art department employing two artists. Your President also attended the Scientific Exhibit of the American Medical Association in New York and made many visits to the World's Fair Medical and Public Health displays. While the quality of the photography in all these exhibitions shows marked improvement over those of five and ten years ago, there is still too much work of poor quality being used. Everywhere transparencies are being employed, particularly when color predominates. This pro-

cedure is very effective, but when used in a crowded room or rooms with low ceilings and sub-divided into small booths, it results in the by-product of terrific heat. At the display of the American Medical Association this condition was so marked as to spoil the show completely. The same method executed at the World's Fair, however, with the advantage of wide aisles and high ceilings, gave splendid results. It is my opinion that the power of the lights used in both places was greater than was required.

It should be noted that too often pictures showing fine detail are placed so high as to be quite useless; the same is true of the lettering. This indicates that the material was prepared with respect to its individual merits, without due consideration of its relation to other items and the position it was to occupy in the assembled scheme. Our members working in photographic divisions should, it seems to me, attend as many scientific exhibits as possible and study the displays. Commercial displays should not be overlooked, as these are made by professionals. Some of them may appear too commercial but from others very good ideas may be gleaned. If possible, collaborate with your chief in the preparation of exhibition material and the planning of the finished display. In this way you will be in a much better position to know how to make the various parts that contribute to an effective whole.

Our financial matters will be placed before you in the Treasurer's Report. She will try to show you where the money came from and where it went, in detail. Among other items, there will be included a statement pertaining to the wind-up of the journal account with the last publisher. This was not very satisfactory to either party because, for unavoidable reasons, the contract had to be discontinued at the end of the first year—a period which is always the most difficult.

New Projects

About 40 per cent of the new projects listed by our members on their renewal blanks has to do with color photography. As 24 per cent deals with books or articles written on photography, more than half of the actual photographic projects involve color. Six per cent are using polarized light for their color photography. Much interesting work is described, and the titles of a number of articles are given. We wish that we had space to list them all. However, the information is carefully filed so that we may keep up-to-date on our members' interests. We wish to thank those members who listed new projects undertaken. Since we meet only a fraction of our members at Conventions, it is important to keep in touch with the others. The more you tell us, the better we know you, and the better the B.P.A. is able to represent your interests.

News From the Trade

Simplified Scientific and Clinical Photography with the Cameron Clinical Camera

It has been found after extensive study that the average person can completely master the operation of the new Clinical Camera that has been developed and perfected, in the course of not more than a roll or two of film. Many users report that their first roll of Kodachrome comes out with 100 per cent good "takes."

An outstanding feature of the Cameron Color Flash Clinical Camera is the method employed in light control. A standard photo flash bulb is used as the prime source of illumination. This is enclosed within the body of the camera, thereby eliminating the necessity for one or more reflectors and light cords necessary to operate them. The light is synchronized with the shutter and is projected through a variable diaphragm against a reflecting mirror set at the proper angle to the axis of the lens. The mirror concentrates and directs the light into a beam that is projected on to the subject or through the lumen of an endoscope, speculum, or other instrument uncovering the area to be photographed. By "shooting" through the center of the beam of light, shadows and major reflections that distort color values in color photography are eliminated, which because the condition of tissue can many times only be determined by its color, makes the instrument of untold value for clinical purposes.

The camera is a true reflex camera; that is, the lens that is used in making a picture is also used for viewing the field up to the instant of exposure, thereby eliminating the necessity of compensating for parallax.

News from Agfa Ansco

New-Type Finopan: A new, improved type of Agfa Finopan, incorporating definite advantages over the film previously supplied, is now available and being distributed through regular photographic dealers. The new film, which is being supplied in the same cartons as the older type, is identified by the words, "New Improved Type," appearing on the outside of the carton.

Chief among the advantages brought by the new Fino-Pan emulsion is a measurably finer grain structure which aids in giving negatives capable of great enlargement with remarkable detail and absence of grain. Coincident with this improvement, the inherent gradation of the New-

Type Finopan is slightly softer—a feature that is particularly suitable for enlarging purposes.

The recommended developing time for the New-Type Finopan in Agfa 17 is 9—12 minutes at 65°F.

The new-type emulsion is being supplied in all 35mm. miniature sizes (20-exposure and 36-exposure Leica cartridges: 36-exposure Contax spools; 24-exposure Memo cartridges; and 27½, 55 and 100 ft. bulk lengths) and in popular roll film sizes.

New 5 x 7 Outfit: Incorporating construction features that give it remarkable compactness, low weight and great ruggedness, this new Agfa Ansco Studio Camera will prove to be a highly useful unit for the small studio which confines its work to negatives of 5x7 and for portraiture, the outfit will also be especially suitable for home-portrait photographers and branch studios. Although smaller than many units used for studio work, the camera provides more than adequately for usual portrait requirements. A bellows extension of 17 inches makes the camera usable for any lens ordinarily employed for studio work with a 5x7 camera. A built-in sliding back simplifies the making of half-5x7 negatives without resorting to additional attachments. Other interesting features include: a new, modern front board and frame design; a new base construction with double tripod sockets for added rigidity, and a large and accessible lens board.

Numbered Film Holders: Agfa Ansco Numbered Film Holders, which have been supplied in the 4x5, 5x7 and 8x10 inch sizes, are now also available in the 3¼x4¼ inch size. These holders provide positive identification of negatives by means of a small, numbered stencil in the corner of each side of the holder. The number which is recorded by the stencil on the film during exposure is also marked on the outside of the holder for rapid identification. The holders are provided *only* in sets of twelve, numbered as follows: Set A (1-24); Set B (25-48); Set C (49-72). They cannot be obtained in less than complete sets. These holders are carried by photographic dealers at list price of $33 per set.

Agfa Infra-Red Now Available in Three Roll Film Sizes: In response to the wide interest evidenced by amateur photographers in the possibilities presented by infra-red photography, Agfa Ansco is now supplying a new, 8-exposure Infra-Red roll film in three popular sizes. This new Agfa Infra-Red roll film is coated with an emulsion similar to the well-known 35mm. Infra-Red film. Other specifications of Agfa Infra-Red roll film include fine grain size, moderately brilliant gradation, and an effective type of anti-halo protection.

The Amberg File and Index Company of Kankakee, Illinois manufactures files for 8 and 16mm. motion picture film and also miniature, 3½x5 and 5x7½ inch negative files, complete with separate index. Glassine negative protectors and looseleaf print albums are also made. These files are sold under the name "Amfiles."

New Kodatron Speedlamp for Ultra-Speed Photography

A completely modernized lamp for ultra-speed photography in all its branches, incorporating an improved circuit, new safety and convenience features, is now ready for distribution by the Eastman Kodak Company through a licensing arrangement with Dr. Harold E. Edgerton and associates of the Massachusetts Institute of Technology.

The new unit, to be known as the Kodatron Speedlamp, utilizes a gas-filled, electrically-operated flash tube, providing an extremely high volume of light, comfortable to the eye and well balanced for photographic purposes, at an effective flash speed of about 1/30,000 second. A summary of the advantages, as ascertained thus far, includes.

1. Critically sharp pictures of subjects moving at high speed.
2. Simple, positive synchronization with most types of camera shutters, and no need of adjustment for lag.
3. Ability to flash any number of lamps in unison, with perfect synchronization, by means of simple photocell control units which eliminate the need of wiring from lamp to lamp.
4. High-speed color photographs with Kodachrome Film, in addition to black-and-white photographs.
5. Great depth of field, owing to the small apertures which are made possible by the high volume of light.
6. Uniform volume of light at each flash, with no practical deterioration as the flash tube ages.
7. Long life of the flash tube (upwards of 5,000 flashes).
8. Subject comfort in pictures which include models, and better conditions for commercial subjects such as food displays which deteriorate readily—since the Kodatron lamp is free from the heat produced by conventional high-wattage studio lamps.
9. Accuracy of modeling; a modeling, or focusing lamp being centered in each flash tube so that the angle of lighting is precisely the same for both flash and modeling light. The modeling light also gives a faithful preview of the light balance that will be obtained in the flash photograph.
10. No eye discomfort for subjects, because of the extreme brevity of the flash. To the eye, the Kodatron flash appears much softer and far less intense than other types of photographic flash illumination.

11. Normal pupil size in a subject's eyes, owing to the moderate illumination level used in modeling and focusing.

12. A specially-designed reflector which yields illumination intermediate between that of a spotlight and a floodlight. Well suited for general lighting, the reflector is also directional enough to increase the intensity along the axis to a considerable degree, for shots at long range.

13. Unique economy of operation, owing to the long life of the flash tube, extreme durability of tubes in the power unit, and an indefinitely long life for the power unit itself.

14. Low power consumption, which effects a substantial two-way saving: first, in lower electric bills; second, in the studio wiring requirements. The Kodatron Speedlamp does not require the special wiring necessary for ordinary studio lamps.

15. Reasonable portability. Reflectors and power units for three lamps can be carried in the rear end of a business coupe or sedan.

With the Kodatron lamp, one flash can be made every ten secseconds—this being the charging time of the condenser. The charging takes place automatically, and the ten-second period allows convenient time for changing film and resetting the camera shutter. Current consumption is quite small during the charging cycle—about five amperes at the start, decreasing in a few seconds to less than one ampere. Two to three of the lamps can be operated safely on an ordinary house-lighting circuit fused for 15 amperes.

The Kodatron Speedlamp, as now available, is a compact, efficient studio unit. It consists of a power unit 8 x 10 x 9 inches, and an 18-inch spun-aluminum reflector on a telescoping steel stand which can be extended to a height of 8 feet—both mounted on a small tray-top steel base to which rubber-tired, swiveled casters are attached. Finish is gray, with some metal parts finished in polished chrome.

Price of the complete Kodatron Speedlamp unit, ready for use, is $400. The Kodatron Flash Tube, for replacement at intervals of 5,000 or more flashes, is priced at $30.

F. R. Harding.

Association News

THE Milwaukee meeting, to which Mr. Massopust has been inviting us for five years, took place September 12th-14th at the Hotel Schroeder and was a success in every way. Delegates registered from fourteen states and Canada.

A particularly stimulating feature of the Convention was the Association breakfast, held on Friday, September 13th. In spite of the date—and the early hour—practically all the delegates staying at the Schroeder met in the dining room allotted to us by a very cooperative hotel management. There, with the sun streaming through the windows and a good breakfast before us, we discussed matters that do not come up in other types of meetings. We talked about the Association's job of making its work known; and of informing scientists on the possibilities—and, equally, the limitations—of various types of photography. It was not a business-meeting, nor a banquet, nor a round-table discussion, but a friendly gathering that combined the best elements of all three. At this breakfast a new committee began to take shape, the B.P.A. Committee of Public Relations, about which you are certain to hear more later.

The Salon was interesting but here again, as last year in Pittsburgh, it contained too few contributions from our members. At least 45% of the entries came from Milwaukee firms and institutions, or from non-member photographers who had accepted our invitation to exhibit. In a large Salon this amount of outside work would not be conspicuous, but in a comparatively small Salon it emphasizes too few B.P.A. entries. Without losing any of our outside contributors, this percentage ought to be cut in half by more active member-participation. The work shown was of high quality and covered several fields. It has since started on its way as our Traveling Salon. A list of the contributors' whose work was accepted appears elsewhere in this column.

The commercial exhibitors were all incorporated into the program this year, so that their material, such of it as was presented formally, is in the hands of the Editor along with other Convention papers. A good deal of interest was shown, during the meetings, in endoscopic photography. Via various tubes and appliances, parts of the body appeared on the projection-screen which have until recently been no-camera-man's land. This endoscopic work presents difficult problems, especially in color-photography, and is a fitting field of study for the B.P.A.

Election of Officers and Directors

The following officers were elected at the Milwaukee business meeting:

President ---------- Leonard Julin
Vice-President ---------- Ferdinand Harding
Secretary ---------- Anne Shiras
Treasurer ---------- Stella Zimmer

A list of the Directors is given below. Those whose terms extend from '40-'43 were elected at Milwaukee.

Ralph P. Creer ---------- 1940-43	Wm. L. M. Martinsen ---------- 1938-41
Melvin A. Dillman ---------- 1938-41	Arthur Proetz ---------- 1939-42
C. Graham Eddy ---------- 1940-43	Oscar Richards ---------- 1940-43
Jean Kieffer ---------- 1939-42	Louis Schmidt ---------- 1940-43

Salon Chairman—Mr. N. S. Horton, advertising manager of the Ayerst, McKenna and Harrison Co. of Montreal, Canada, was named Salon Chairman. We have increasingly felt the need of a Chairman who functioned throughout the year.

1941 *Convention City*—An invitation to Buffalo was extended by Mr. Payne, and one to New York City by Mr. Schmidt. These cities, and Washington, D. C. were discussed in the business meeting. Washington was the general favorite. The members felt that in spite of our having no local chapter there, a good program should be forthcoming because there was so much work to choose from. It may be that the defense program will crowd Washington to such a point that a meeting there will be impossible. The members voted that in this case another city would be chosen at the discretion of the Board. Barring such contingencies the slogan is "On to Washington!"

SUSTAINING MEMBERS

The following are our Sustaining Members for 1940-41:

Louis Paul Flory
Boyce Thompson Institute
for Plant Research, Inc.
Yonkers, N. Y.

Dr. Arthur W. Proetz
3720 Washington Boulevard
St. Louis, Missouri

Dr. George H. Semken
16 West 85th Street
New York, N. Y.

Anne Shiras
University Office
Magee Hospital
Pittsburgh, Pa.

Lloyd V. Varden
Agfa Ansco Corp.
Binghamton, N. Y.

Forestry

The Journal of the Biological Photographic Association

MAR 13 1941

MARCH

VOLUME 9 — 1941 — NUMBER 3

LEO C. MASSOPUST,
EDITOR

For the advancement of photography in relation to the biological sciences.

Published Quarterly For The Biological Photographic Association At 1300 National Avenue Waukesha, Wisconsin

OFFICIAL PUBLICATION OF THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION

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PUBLISHED QUARTERLY FOR THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION INC. AT 1300 NATIONAL AVE., WAUKESHA, WIS.

Entered as second-class matter at the Post Office at Waukesha, Wis., under the act of March 3, 1879.

Subscription price $3.00 per volume. Single copies 75 cents.

The Journal of the Biological *Photographic* Association

Official Publication of the Biological Photographic Association

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VOLUME IX NUMBER 3

MARCH » 1941

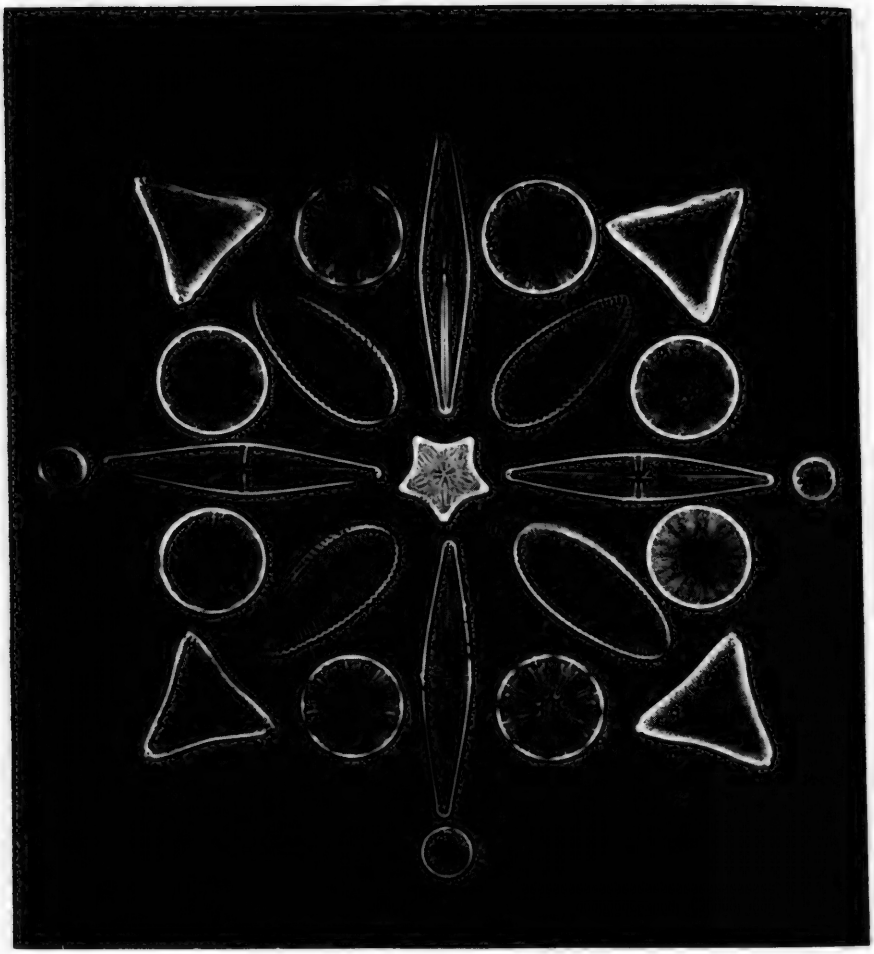

Figure 1. Arrangement of diatoms. X 230

Is the Diatom Coming Back?

by Leo C. Massopust *

ON January 11, 1941, the Special Room for the study of diatoms and myoxmycetes was formally opened on the third floor of the Museum Building of the New York Botanical Garden. The new room houses the Garden's large collections of myxomycetes and diatoms, the literature pertaining to them, and is furnished with tables and a microscope for the use of research students of these groups. Several very interesting papers have been published in the Journal of the New York Botanical Garden on the fascinating subject of the diatom.[1]

Simultaneous with the above announcement I came into possession of a very fine collection of old microscopic preparations which were found among the effects of Dr. Adelheim Bernhard who practiced medicine in Milwaukee. They were contained in a beautiful small black walnut chest of trays. To the unnamed mounter of one of the slides, dated 1867, a medal was awarded in Paris in the same year, probably at the first International Medical Congress. This year also marked the introduction of antiseptic surgery by Lister, and for purposes of correlation, the Pacific Railway and the Suez Canal were opened.

No attempt will be made to enter into a scientific discussion of these beautiful specimens. Nor do I wish to presume that there is anything unusual in the photographic technic involved in the illustrations contained herein. My purpose in presenting this paper is merely to call attention to the finesse in the preparation of these slides, to their historic interest, and to the fact that the diatom affords an excellent source of study, photographically, for the biological photographer.

In order to bring to the attention of the reader the meticulous technic which is necessary in the manipulation of these minute organisms, I quote from *The Microscope and Its Revelations,* by Carpenter, 1881: "The mode of mounting specimens of *Diatomaceae* will depend upon the purpose which they are intended to serve. . . . If the minute structure of the siliceous envelope is the feature to be brought into view, the fresh Diatoms must be boiled in nitric acid or hydrochloric acid which must then be poured off (sufficient time being allowed for the deposit of the residue); and the sediment, after being washed, should be

* Received for publication January 30, 1941 from Marquette University School of Medicine, Dept. of Anatomy, Milwaukee, Wisconsin.

[1] Vol. 41, No. 492, Dec. 1940 and Vol. 42 No. 493, Jan. 1941.

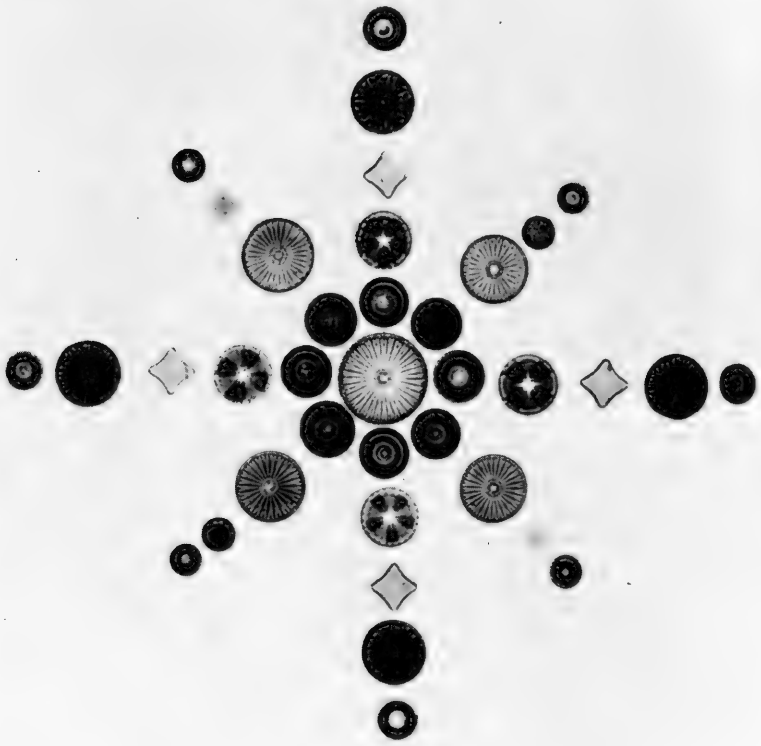

Figure 2. Arrangement of diatoms. X 40

boiled in water with a small piece of soap, whereby the Diatoms will be cleansed from the flocculent matter which they often obstinately retain. After a further washing in pure water, they are to be either mounted in Balsam in the ordinary manner, or to be set-up 'dry' on a very thin slide. . . . It will often be convenient to mount certain particular forms of *Diatomaceae* separately from the general aggregate; but on account of their minuteness, they cannot be selected and removed by the usual means. The larger forms, which may be readily distinguished under a Simple Microscope, may be taken-up by a camel-hair pencil which has been so trimmed as to leave two or three hairs projecting beyond the rest. But the smaller can only be dealt with by a single fine bristle or stout sable-hair, which may be inserted into the cleft-end of

a slender wooden-handle; and if the bristle or hair should be split at its extremity in a brush-like manner, it will be particularly useful. (Such split-hairs may always be found in a shaving-brush which has been for sometime in use; those should be selected which have their split-portions so closely in contact, that they appear single until touched at the ends.) When the split extremity of such a hair touches the glass-side, its parts separate from each other to an amount proportionate to the pressure; and, on being brought up to the object, first pushed to the edge of the fluid on the slide, may generally be made to seize it. A very experienced American Diatomist, Prof. Hamilton Smith, strongly recommends a thread of glass drawn out to capillary fineness and flexibility, by which (he says) the most delicate Diatom may be safely taken up, and deposited upon a slide dampened by the breath."

Consider now the painstaking effort employed in producing the arrangements in figures 1, 2, 3. Note first of all that each type of diatom

Figure 3. Arrangement of one-hundred diatoms. X 55

repeated in the general design is of the same size, and that each is nearly a perfect specimen. Some idea of the minuteness of these specimens can be obtained from the magnifications which are indicated. In figure 1 the actual composite pattern on the microscope slide measures approximately .5 mm or 1/50th of an inch. The arrangement illustrated in figure 3 consists of one hundred types of diatoms. On this slide is engraved, in the glass, the name of the mounter, J. D. Möller, Wedel in Holstein, Germany, 1871.

A word of comment may also be in order regarding the preservation of these specimens, for in spite of the fact that they were prepared over 70 years ago, they are apparently as good now as the day they were made. It is fortunate for contemporary investigators that these excellent old preparations are so well preserved, for without doubt it would be almost impossible to duplicate the valuable collections which are now available for study.

To the biological photographers who have not dwelt on these humble forms of vegetable life, I can predict that they will be fully rewarded by a most attentive scrutiny of these beautiful simple cells, which present ccuntless perfect geometric designs.

Nature Salon

Hobbies, the magazine of the Buffalo Museum of Science, in its current issue (February) announces its third annual nature salon and invites photographers to share their nature "shots" with other photographers and other nature lovers.

"With beauty and interest all about us, it nevertheless takes an alert and observing eye to catch the unusual sight, the pictorial mood, the fleeting dramatic moment. The purpose of the nature salons conducted by *Hobbies* is to encourage an appreciation of the world in which we live," the announcement says.

The judges—Wilbur H. Porterfield, staff photographer, Buffalo Courier-Express; Emil Strub, instructor in photography, Niagara County Sanatorium; and Dr. Carlos E. Cummings, director, Buffalo Museum of Science—will award cash prizes for the three best pictures in the show as well as select the three best in each of six classes: Mammals, birds and nests, plant life, scenery, miscellaneous, and decorative. Full details and entry blanks may be obtained from the Museum, Buffalo, New York.

The closing date for entries is May 12, and the salon will be hung in the Buffalo Museum of Science during the month of June.

Color Photography of the Human Ocular Fundus:

*Its Technic With The Zeiss-Nordenson Retinal Camera**‡

by Ferdinand L. P. Koch, M. D.†

Introduction

THE camera most commonly employed throughout the world for photographing the interiors of living eyes is the Zeiss-Nordenson retinal camera. The model favored by the author is flare- or reflex-free, and disturbing reflections from the surface of the cornea or from other refractive media of the eyes do not appear on the photographs, figures 1, 2, 3 and 4. Some workers, however, prefer the apparatus that produces a central reflex on the exposed film.

The pioneer work in retinal photography began in 1862 with Noyes[1] who apparently was the first to attempt photographic delineation of the human eyegrounds. von Helmholtz[2] in 1851 had solved the problem of projecting an illuminating beam of light upon an observed retina so that its image would fall upon the retina of the observer and, thus, permit ophthalmoscopic examination of the internal structures of living eyes in health and in disease states.

Numereous investigators gradually succeeded in eliminating technical difficulties but a serviceable photograph of the human occular fundus was not obtained until Gerloff[3] in 1891 procured fairly good delineation of retinal structures after he had minimized the corneal flare by immersing the exposed part of the eye in a water chamber. This, in effect, was a hydro-diascopic arrangement.

Present methods probably derive from the work of Dimmer[4] who, from 1899 to 1906, developed with the aid of Kohler and von Rohr of the Zeiss works an apparatus from which flares and halos had been

* Read before the Biological Photographic Association, Milwaukee, Wisconsin, September 12-14, 1940.

‡ Figures 1 to 6, inclusive, were reproduced from Zeiss descriptive catalogs, Med 38/IV and Med 37/V e.

† Institute of Ophthalmology, Presbyterian Hospital, New York, New York.

[1] Noyes, H. D.: Discussion of Dor's presentation. Tr. Internat. Med. Cong., Copenhagen, Denmark (1884), p. 34.

[2] von Helmholtz, H.: Beschreibung eines Augenspiegels zum Untersuchungen der Netzhaut im lebenden Auge. Berlin, Förster, 1851.

[3] Gerloff, O.: Ueber die Photographie des Augenhintergrundes. Klin. Monatsbl. f. Augenh. 29:397-403, 1891.

[4] Dimmer, F., and Pillat, A.: Atlas photographischer Bilder des menschlichen Augenhintergrundes. Leipzig und Wien, Franz Deuticke, 1927, 30 pl.

eliminated by the geometrical method of lens alignment. Consistently excellent black and white photographs of human eyegrounds were ob-

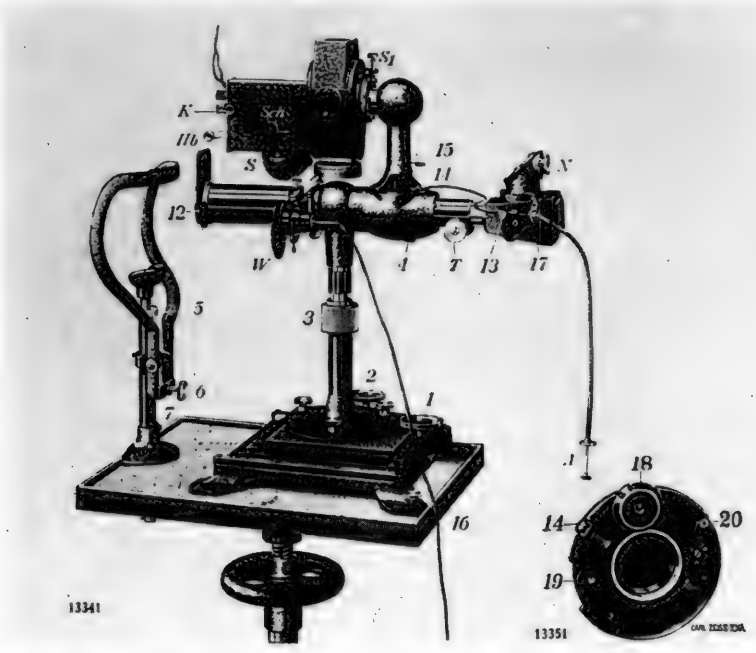

Figure 1. Nordenson reflex-free retinal camera with carbon arc lamp, Wessely fixation device, chin support and head rest, mounted on compound slide on instrument table. The detail of the Compur shutter is depicted in the smaller figure to the lower right.

tained with this large and very expensive instrument of which only two were manufactured. The first of these is in the Eye Clinic in Vienna but the second one remains on exhibition in the manufacturer's museum in Jena[5]. The excellence of Dimmer's photographs brought closer to realization the prediction of Javal in 1888 "that photography of the fundus would be of great value in ophthalmology[4]."

Nordenson[6] in 1915 modified and greatly simplified the elaborate apparatus of Dimmer by the application of the principle of non-reflecting central ophthalmoscopy as it was embodied in Gullstrand's simplified large ophthalmoscope. He obtained a series of beautiful retinal photographs in black and white with his rather makeshift apparatus. The

[5] Koch, V. M. E.: Personal communication (Carl Zeiss, Inc.), (July) 1940.
[6] Hartinger, H.: Zeiss-Nordenson's flare-free retinal camera. British Optical Association Lecture Week. Demonstration by Dr. Hans Hartinger at the London School of Hygiene and Tropical Medicine, Keppel Street, W. C. 1, May 20, 1930.

sun was the source of illumination. These pictures were of adequate size being about five and one half to six times the breadth of the optic nervehead as it appeared in the photograph; that is, about 40 mm. in total diameter.

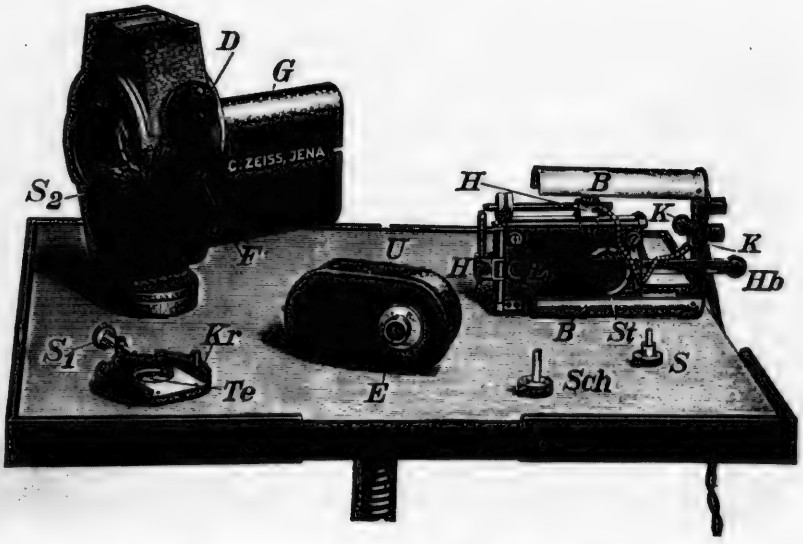

Figure 2. The component units of the small carbon arc lamp.

Nordenson's simplification permitted the development of the apparatus as a commercial proposition. The camera was altered in cooperation with the Zeiss works during the ensuing years and manufacture in quantity was begun in 1926. Since that year there have been distributed throughout the world approximately three hundred and fifty of these instruments. Doctors Arthur J. Bedell of Albany and R. von der Heydt of Chicago in 1927 were the first in this country to have used these cameras about ninety of which were sold in the United States.[5]

The only other camera on the market is the reflex-free instrument devised by Salomonson but it is in limited use. The Zeiss-Nordenson retinal camera has been found to serve all practical purposes.

The excellence of his pictures resulted in the publication in 1907 of a small atlas of fundus photographs by Dimmer[7] and, in 1927, there appeared a more comprehensive work by Dimmer and Pillat.[4] Bedell[8]

[7] Dimmer, F.: Die Photographie des Augenhintergrundes. Wiesbaden, J. F. Bergmann, 1907, 142 pp.

[8] Bedell, A. J.: Photographs of the fundus oculi. A photographic study of normal and pathological changes seen with the ophthalmoscope. Philadelphia, F. A. Davis Company, 1929, 317 pp.

in 1929 offered a splendid atlas in which there appeared many stereoscopic plates. The work of Bothman and Bennet[9] in 1939 was entirely

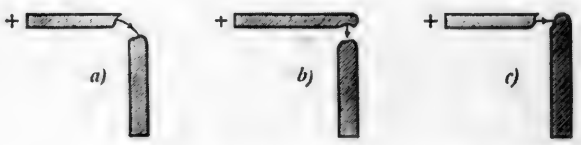

Figure 3. Correct (a) and wrong (b, c) positions of the carbons when operating with a continuous current.

stereoscopic. The pictures in the two former publications were obtained with Dimmer's elaborate apparatus while the two latter atlases were compiled with photographs taken by Nordenson's simplified instrument. All of these pictures are in black and white.

Color photography of the ocular fundus is a relatively recent development. Early investigations involved the use of Dufaycolor and

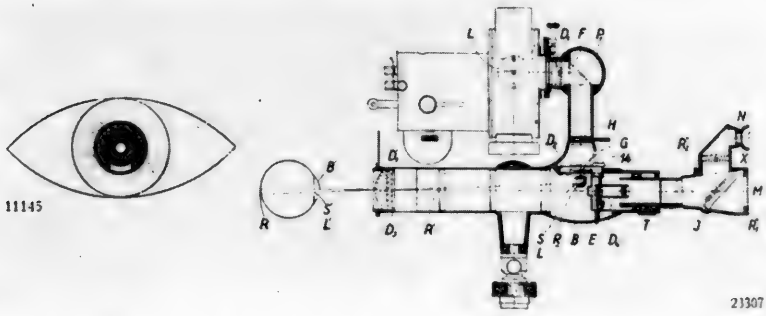

Figure 4. The trace of the rays in the Nordenson retinal camera and the position of the images B′ and S′ of the objective stop B and the slit S in the patient's pupil shown diagrammatically. The image B′ being dark, is not actually visible.

Agfacolor plates but their relatively coarse grain rendered impractical their use for anything but transparencies.[10] Redway, working at the Institute of Ophthalmology, was one of the first to employ these plates but, with the advent of Kodachrome film the use of color in fundus photography became somewhat more general. The first good pictures of human

[9] Bothman, L., and Bennet, R. W.: Fundus Atlas. Stereoscopic photographs of the fundus oculi. Chicago, The Year Book Publishers, Inc., 1939, 50 pl.

[10] Bedell, A. J.: Color photography in ophthalmology. In: Modern trends in ophthalmology. London, Butterworth & Co., Ltd., 1940, pp. 213-223.

eyegrounds in color on film were obtained approximately five years ago by Bedell and by von der Heydt who are believed by Koch[5] to have been the first to have used Kodachrome film for this purpose. Color film in fundus photography undoubtedly will come into wider use when reproductions for publication and demonstration become less expensive and when a standard, practical film adapter or carrier for the retinal camera is devised to replace the original plate holders.

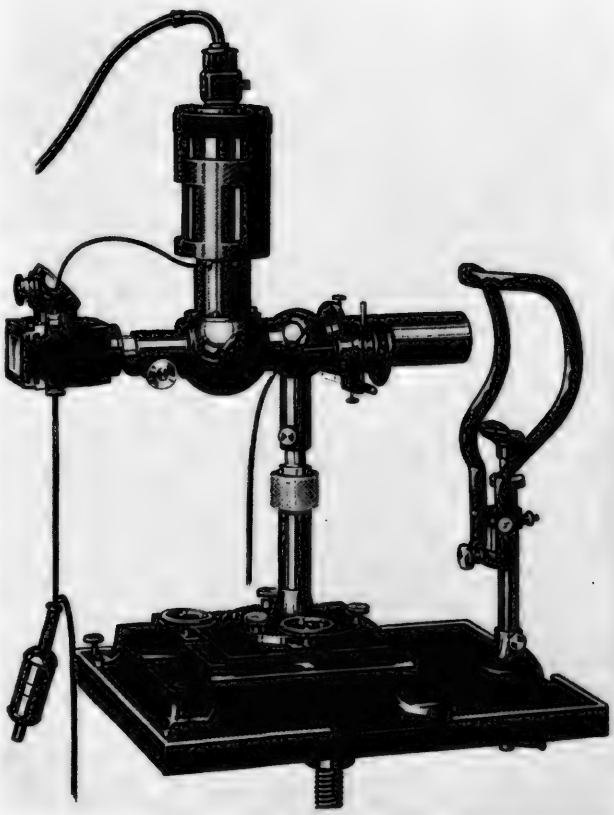

Figure 5. Zeiss retinal camera with filament lamp.

Value of Fundus Photography

It is desirable to obtain photographic evidence of normal and of pathologic alterations of the human organism in whole or in part since the findings preserved by these records frequently are of invaluable medico-legal importance. Their more prosaic but wider usefulness for teaching, demonstrations and for the purpose of following clinical progress is well known to medical workers. The condition at any given time of the normal retinal structures and their numercus variations is readily illustrated by photographic methods, figures 7 and 8.

An enumeration of the changes noted ophthalmoscopically in the eyegrounds cannot be made here but these changes may be divided

arbitrarily into several large groupings the chief of which are those in which alterations in the retina or of its structures occur co-incidentally with, or subsequent to, systemic diseases of the body or physiologic-pathologic alterations elsewhere in one or more organs.

Diffuse vascular disease such as essential hypertension associated with pathologic elevation of the systemic blood pressure will produce more or less characteristic patterns of vascular and retinal alteration from the normal in the eyegrounds, figures 9 and 10. Primary diseases of the blood, metabolic disturbances such as diabetes mellitus and the malnutritional states subsequent to vitamin deficiencies will bring about visible changes in certain phases of their clinical courses, and these changes may be photographed. Numerous debilitating diseases produce somewhat characteristic lesions in the eyegrounds, and certain intracranial diseases or lesions often cause more or less characteristic retinal and nervehead alterations, figure 11. A number of hereditary degenerative and inflammatory disease entities, both general and local, cause architectural changes of the retina and of its structures. The eyeground picture is dynamic and, hence, fundus photography often is of aid in diagnosis, treatment and in prognosis, and it may be of assistance prophylactically in directing attention to the inception of a disease process.

The potentialities of fundus photography in ophthalmologic research barely have been touched upon. Variations in caliber of the retinal vessels, both in health and in disease and under different pharmacologic conditions, offer a wide field of usefulness for photographic records during the investigative phases of the problem at hand. Vital staining of the retina may be followed with accuracy by means of fundus photography. Problems concerned with the origin of inflammatory disease states may be followed particularly well by animal experimentation.

The Fundus Camera

The Zeiss-Nordenson retinal camera embodies the principle of flare-free central ophthalmoscopy by means of which the image-forming rays traverse the median and more optically valuable portion of the eye while the illuminating rays traverse the inferior and more peripheral portion of the pupil of the eye under observation. The fact that these two systems of rays are minimally but sharply separated while passing through the several refracting surfaces and media of the eye assures an absence of reflective flares, freedom of the image from blurs and an optical combination that furnishes clear imagery and detail out to the edge of the field.

The apparatus in its essentials is a form of reflex camera constructed with a Compur shutter acting in conjunction with a powerful source of light together with an arrangement for transmitting that light into the eye in full strength. Photographs of the ocular fundus thus may be obtained with short exposures at favorable moments. An interposed greyed glass allows the operator to prolong the period of observation while focusing the image by moderation of the light for the comfort of the patient. The release of the shutter causes the greyed glass to recede automatically.

The image-forming rays return from the retinal structures of the interior of the eye through the center of the previously dilated pupil and back to the end of a twenty-inch adjustable tube. A plate holder or film carrier is interposed in the plane of the photographic layer. A mirror, also interposed in this plane but situated in front of the adapter and at an oblique angle, permits the transference of the formed image to be viewed through the finder by means of adjustments of the focusing lens.

The source of light in the majority of these cameras is a carbon arc lamp designed to operate with an alternating or with a continuous electric current of five amperes and connected to a circuit with a fuse blowing at six amperes together with a resistence of fifty ohms (5 amperes). It is estimated that the carbon arc lamp at the moment of exposure upon release of the shutter by the hand op-

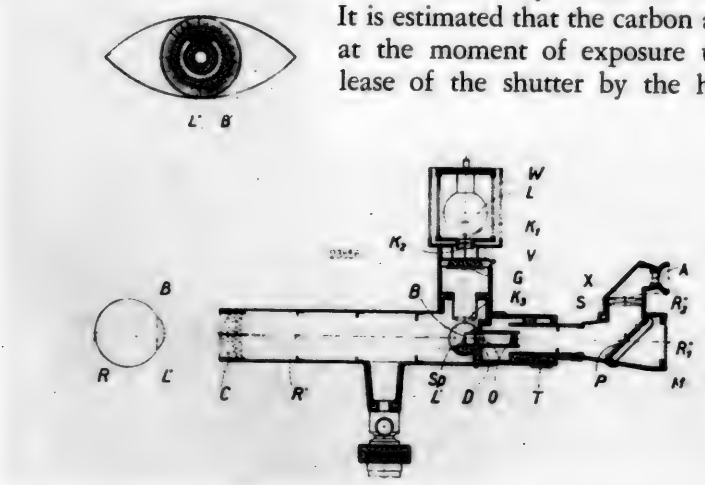

Figure 6. The trace of the rays in the Zeiss retinal camera with filament lamp. The position in the patient's pupil of the image B' of the diaphragm of the observing system, and of the image L'' of the lamp filament. The image B' of the diaphragm, being dark, is not actually visible.

erated cable produces an intensity of approximately six hundred candle power.

The apparatus has been altered from time to time and minor improvements have been added. The carbon arc lamp in the older models projected an image of a crescent-shaped portion only of the positive crater on to the plane of the lower edge of the pupil. A filament lamp known as the nitra lamp now has replaced the arc as the source of illumination, figures 5 and 6. The entire ring filament of this 12 volt, 100 watt lamp is projected on to the plane of the dilated pupil. Greater efficiency is claimed for this innovation which permits operation at 7.2 amperes on the more widely used alternating electric current. No adjustment of the filament to the optical system is required since compensation for deviations of the filament is supplied by a centering cap on the lamp. The overloading of the lamp at the instant of exposure provides an estimated nine hundred candle power of intensity of illumination. The carbon arc lamp has the disadvantage of dissipating its generated heat rather widely while the nitra lamp radiates its heat to the outside air through a ruby glass cylinder. Opinion differs with regard to the desirability of either of these sources of illumination.

The exposure is made by pressing the cable release. This raises the mirror interposed in the photographic layer and allows a free path for the light to travel to the film. The release sets in motion the shutter and the greyed glass at the moment that the mirror reaches its top position; thus, the exposure is made at the speed at which the Compur shutter mechanism already has been set. The latter is provided with a lever to be depressed by the finger prior to pressing the cable release but only after the desired exposure time has been fixed by turning a numbered disk to the desired indicated length of exposure time. The latter has a range in fractions of time from 1 second to 1/250th of a second.

Supplementary lenses in a Recoss disk may be interposed in the long tube in instances of marked ametropia when the refractive error is more than seven diopters plus or minus. These lenses may be brought into place in front of the objective so that sharp focusing of the retina is obtained.

The field of view under normal refractive conditions is approximately thirty degrees. The magnification under similar circumstances is approximately five diameters although it may rise to over 6 or fall to as low as 3 diameters depending upon the refractive state.

The camera and the light source are incorporated as one instrument that is mounted on a finely adjustable moveable base. The latter is placed

on a heavy optical table so that the long ophthalmoscope end of the instrument is immediately opposite the chin cup and frame for the head of the patient.

Stereoscopic photographs to obtain relief effects and to give an impression of depth are desirable particularly because of their clinical value. It will be recalled that stereoscopic vision results from the simultaneous visual appreciation of two slightly dissimilar images. The Wessely fixation device for use with the Nordenson camera assists the patient to fix the gaze on small luminous points that can be shifted to different positions thus enabling the operator to photograph the fundus under the same conditions but from slightly different angles. Bedell[10] has devised a somewhat less exact but more practical method for taking stereoscopic pictures. He employs the simple expedient of displacing the moveable base about 44 mm. for the second picture after the first exposure has been made. The head of the patient must remain immobile and the gaze should be maintained on the same point as for the first exposure. The Nordenson stereoscopic instrument was devised as a separate apparatus and enabled the operator to take two pictures of the fundus with one exposure after the eyeground was properly focused. The method theoretically is the correct one but it was not always practicable because some pupils will not dilate to the width required.

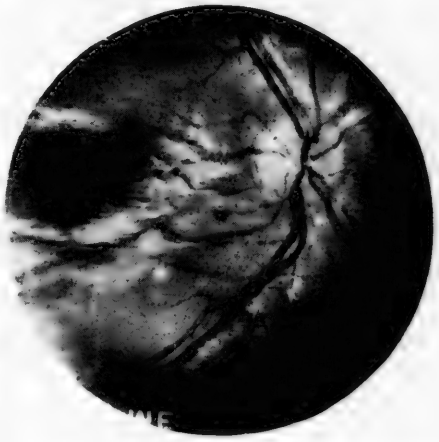

Figure 7. Right eye. Normal brunette fundus.

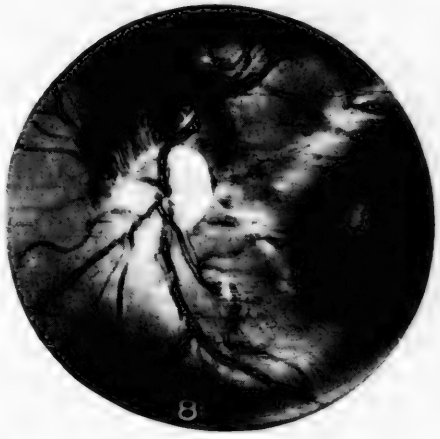

Figure 8. Left eye. Normal brunette fundus. Benign melanoma of choroid partially encircling optic disk.

Type of Film

The retinal cameras originally were constructed to receive plates and not film for exposure but the introduction of fine grain black and white film and of grainless color film necessitated the construction of an adapter or carrier for use on the same type of base as that of the original standard plate holder. The adapters or roll carriers vary according to the individual designs of some operators but the most useful, if not also the most fragile, carrier is the Rollex adapter which holds a roll of 35 mm., Bantam type, eight-exposure film. This carrier was obtainable through Carl Zeiss, Inc.

Figure 9. Left eye. Retinitis of malignant hypertension.

Figure 10. Right eye. Retinitis of terminal hypertensive phase of chronic glomerulonephritis.

The Bantam film has the advantage over larger rolls in that a partially exposed film does not remain so for too long a time before being sent to the laboratories for processing. Campion[11] stated that there was little difference in the results obtained whether Kodachrome Type A color film (for artificial light) or the color film for daylight was used. He pointed out that the carbon arc, as is known, produces light very similar in quality to that of daylight. He believed that the Type A film produces a truer picture and has more latitude and that ideal conditions, therefore, need not exist for good results. This is entirely at variance with our experience and that of some others. The daylight type of color film affords better transparencies of

[11] Campion, G. S.: Color photography of the fundus oculi. Tr. Pacific Coast Oto-Ophth. Soc. 24:178-183, 1939.

much truer color when the source of illumination is the carbon arc lamp. The Type A film is the best for use with the nitra lamp apparatus.

Kodachrome film, after exposure, is sent to one of the several Eastman Kodak processing laboratories. It is best to request that the film be returned uncut. This will permit of more satisfactory comparison of each exposure on a roll when examined through a small viewing box prior to cutting and mounting the individual transparencies. It usually is more desirable to keep only those pictures which are good and to discard any questionable photographic reproductions of the eyegrounds. Each of the accepted exposures that are to be used for projection purposes should be mounted separately in the usual manner. We prefer the 2″ x 2″ size but the older, standard size also is satisfactory.

Projection of the smaller slides should be accomplished with the newer machines now on the market rather than attempting to employ an adapter or holder for use with the machines employed for projecting the larger standard slides. Projectors equipped with a three hundred to a seven hundred watt bulb are more satisfactory for screen presentation than are those with lower wattages because the great majority of colored fundus photographs are predominantly red and, therefore, rather dense in color.

Preparation of the Patient

Physicians who do their own fundus photography are more apt to select their subjects with greater care than those who depend on technical assistants for obtaining these records. Patients whose eyes have large or unusual refractive errors and those with scars or lesions of the cornea, lens or of the vitreous body are poor subjects in that the factors just mentioned militate against clear, if any, photographic delineation of the eyegrounds. It is desirable, of course, to obtain retinal photographs routinely of the majority of patients in an ophthalmologic office practice; however, this is not always feasible not only for the reasons just noted but, also, due to lack of sufficient time. A technical assistant is invaluable for this work but situations arise in which a requested photograph is unobtainable. It is necessary, therefore, for the examining physician to specify the particular sector or area of the retina and its structures that he wishes to have photographed when a technician is the operator. He may also judge the time of exposure and the intensity of lighting as estimated by his ophthalmoscopic study of the eyegrounds of the patient but it is preferable that this should be determined by the operator himself.

The pupils of the eyes of the patients who may be submitted with safety to dilatation for retinal photography must be dilated to a minimum

of at least 4.5 mm. if the older cameras are used and, if possible, to 7 to 8 mm. in diameter. The widening and immobilization of the pupil permits the ingress and egress of the illuminating beam of light and of the image-forming rays, respectively. If the pupil is more or less immobilized pathologically because of adhesive scars or neurologic disease, or if the eye is glaucomatous dilatation not only may be impossible but it may be dangerous to the preservation of vision.

The older the patient, as a rule, the more should care in the preliminary examination be exercised. Maximum dilatation, however, even if the pupil still remains relatively small, must be obtained to secure immobility of the iris. Reaction of the pupil to light will alter the amount of the light entering the eye from the illuminating beam and the accompanying changes in the shape of the crystalline lens within the eye will affect the focal clarity of the picture.

There are a number of technics for obtaining the proper pupillary dilatation; however, as Bedell[10] points out, homatropine hydrobromide solution, 4% is the most satisfactory drug. One drop of this solution instilled into the lower conjunctival sac at intervals of 5 minutes for two or three doses usually results in maximum dilatation within 40 to 60 minutes. Cocaine hydrochloride solution in concentrations varying from 2% to 10% may be used in elderly or in apprehensive persons but the dehydrating effect on the corneal epithelium not only is annoying but may cause superficial corneal injury. The pharmacologic effect of the cocaine solution is rather transient but it may be used in conjunction either with the homatropine solution or with adrenalin hydrochloride, 1:500 to 1:1000. Neo-synephrine, 1%, also may be used as a dilating adjunct. The pigmentation of the hair and of the skin, however, is a clue to the color of the iris and of the fundus, as Bedell[12] concluded, and it is demonstrable that the more darkly complected the individual the more delayed, within limits, is the dilatation and the more desirable it is to obtain it.

Adjustment of the Camera

Adjustment of the patient to the head rest is equal in importance to the proper adjustment of the camera. If the patient is made as comfortable as the operator himself would wish to be in a similar situation instructions will be followed with intelligent co-operation and the results will be more nearly those desired. The patient should not be permitted to hunch up; the back should be straight and in a natural line with the neck so that breathing is normally accomplished. The chin should rest in the chin cup and the forehead should exert gentle

[12] Bedell, A. J.: The clinical importance of pigment in the fundus. Tr. Am. Acad. Ophth. 41:446-455, 1936.

but continuous pressure against the head frame. The patient should be admonished against talking to obviate the elevation of the head that would follow chin movements, and he should be told to wink his eyes normally. The purpose of the fixation device, whether the Wessely apparatus is used or a light is held by an assistant, should be explained together with the necessity for the maintenance of a fixed gaze upon the point designated, figure 12.

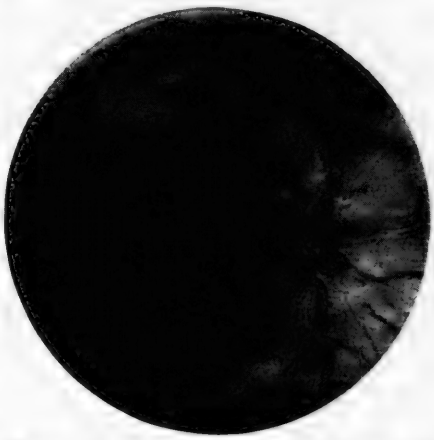

Figure 11. Left eye. Acute optic neuritis showing edema of the optic disk.

A patient whose vision is very poor or nil will immobilize his eyes and maintain a fixed gaze sufficiently for retinal photography if the technic of finger fixation is employed. This is easily done if the hand and arm of the patient is brought forward so that an assistant holds the wrist and makes gentle pressure on a terminal phalanx of a finger of that hand in the position in space to which it has been decided that the subject should be looking. Thus, the position in space of the finger being pressed upon is positionally visualized by the patient and the gaze is directed to that point.

Numerous seemingly inane remarks unfortunately will be made even by intelligent patients, and dull or unco-operative individuals will tax the resources of the operator in spite of the most careful instructions prior to making the actual exposures. The equanimity of the operator will be sorely tried from time to time but, as in other situations in which technical apparatus is employed in clinical procedures, it is most important that courteous patience constantly be maintained under the most trying provocation in order to obtain satisfactory results.

It is best to have all adjustments made before seating the patient and it is well to begin with the important adjustment of the arc lamp. The crater in a direct current circuit forms at the upper or positive carbon and will flow more intensely than the lower or negative carbon. If this condition does not prevail the current is probably flowing in the wrong direction and a proper luminous crater will not be directed into the optic axis of the illuminating system. These carbons should be maintained in proper adjustment during the focusing and exposure procedures. It is more satisfactory to accomplish this by hand although clockwork mechanisms may be obtained.

The finder and focusing eye piece of the apparatus is adjusted so that the convex margin of the sharp, incomplete semicircular edge of the illuminating light slit emanating from the carbon arc lamp is adjusted in sharp focus so that it lies in opposition to the lower margin of the dilated pupil in the same plane as the central border of the iris of the eye of the patient. This intensely bright image is approximately 4 mm. long and has a width of 1 mm. An invisible image exists about 3 mm. above the slit image and has a diameter of about 2 mm., but this will be focused properly when the visible slit image is sharp. The sharpness of the latter can be ensured before focusing it on the patient's eye if it is adjusted to sharpness on a card or piece of paper held in front of the patient.

The newer models in which the nitra lamp is employed as the source of illumination of the eye allow a greater latitude in focusing the image. The latter is projected in its entirety as a serrated, ring filament into the plane of the dilated pupil. It may extend peripherally onto the margin of the iris.

The operator can focus accurately in any of the models the image of the retina through the finder and the focusing eye piece after the light image is properly set and when the patient is gazing at the fixated point. Further adjustments for clarity can be made with sliding movements of the twenty-inch tube and with the aid of the compound, adjustable, horizontal slide and its vertical extension.

The determination of the amperage and the intensity of light desired depends on the degree of pigmentation of the ocular fundus. This is estimated by ophthalmoscopic observation after dilatation of the pupil. The time of exposure varies accordingly. As a rule, the darker the fundus the greater will be the necessity for a more intense light and a longer exposure. The fundus normally may be dark in color or it may have acquired a deeper tint as the result of a morbid process.

Further information in regard to coloration of the fundus and, hence, of the time of exposure and the intensity of the light may be obtained only through experience by observation of the retina under the moderated light afforded by the greyed glass. It requires only a little experience to orient oneself to the position of the structures being observed. Focusing, then, becomes a matter of mechanical adjustment; however, if the patient has a high myopic or hyperopic refractive error of about seven diopters plus or minus and upwards, it will become necessary to bring into play one of the supplementary lenses in the Recoss disk placed in front of the objective. It may be helpful also to use these supplementary lenses if the areas to be photographed are markedly elevated or lowered in relation to the plane of the adjacent retina.

Experience, of course, is very helpful with regard to the time of exposure but it has been found that 1/12 to 1/15 of a second at 5 to 7 amperes for light eyegrounds and 1/10 to 1/12 of a second at 6 to 8 amperes for dark eyegrounds is quite satisfactory when working with daylight Kodachrome film and the carbon arc lamp apparatus.

An eye will remain stationary only momentarily and it is necessary, therefore, to achieve a certain rapid skillfulness in making the required focusing adjustments for clarity of detail before the film is exposed. Campion[11] has cautioned that: "Slower exposures will cause many blurred pictures because the eye will not remain stationary too long, and shorter exposures require an increased intensity of light which may not be tolerated. Several exposures usually will be made and this will result in the intense light being flashed into the eyes an equal number of times. Fatigue on the part of the patient will follow and this will become intensified if the entire procedure is not conducted without waste motion. The photographs obtained usually then will justify the extra effort expended in making them.

Figure 12. Nordenson retinal camera. Position of patient and operator just prior to exposure of film.

There should be mentioned the fact that occasionally it is necessary to wait for a few minutes before attempting photography of the second eye after having made pictures of the first one. The intense illumination often produces such retinal fatigue that the after-image is essentially scotomatous in character and this will prevent temporarily gazing at the required point with the previously photographed but now fixing eye.

Comment

Fundus photographs in color have several advantages over those in black and white. The chief of these is the more realistic and greater clarity of detail in the colored photographs because of the contrast existing in the latter that is impossible to obtain with black and white. It is possible, also, to obtain a nearness to perfection in color that very closely, if not exactly, approximates the color of the fundus observed ophthalmoscopically. The colored photograph, too, appears to be less flat than does the black and white in that the former seems to convey the im-

pression of a curved rather than a flat surface thus resulting in an impression of truer or more natural photographic reproduction of normal contour.

Fundus photographs are thought by some observers to be more valuable than either drawings or descriptions. This undoubtedly is true in regard to the latter, but there are many conditions in which a professional ophthalmic artist can portray changes in a fundus more accurately and with greater detail in a drawing than would be possible to photograph. It is not uncommon to encounter elevations or depressions of one or more portions of the interior of an eye under observation, nor is it unusual to find lesions in the far peripheries of a retina. The latter are difficult to photograph in detail because of corneal reflection and annoying lenticular distortion. Differences in height or in depth of retinal structures result in pictures that reveal blurriness of detail. The variations in depth of field often can be minimized by compromise focusing to minimize confusion circles but usually it is more satisfactory and, therefore, necessary for clinical purposes to make several exposures of various areas or structures of the retina with each particular smaller area in sharp focus.

The practical application of this technic for example is employed in an eye in which there is an edematous optic nervehead which cannot be seen clearly at the same level of focus at which the macular region or the adjacent retina is observed in sharp definition. It is also true in highly myopic eyes where a posterior staphyloma exists, or in eyes in which there is glaucomatous cupping of the nervehead or where there is observed a retinal detachment, massive exudation or an intra-ocular tumor.

Film has the adavntage over plates for retinal photography because it can be handled more easily. Dufaycolor, Color film, Agfa color and Kodachrome all are excellent color films affording beautiful color contrasts under proper exposure and lighting conditions. The operator usually will choose the film or plate that is available in his local market. Kodachrome, at the present time, probably is the most efficient of all the varieties of color films because of its constantly improving quality and the ease with which it can be obtained and processed. It is best, however, to depend upon only one type of film in order to obtain uniformly good results.

It is probable that the daylight or plain type of Kodachrome film affords more nearly perfect color and more distinct contrast and detail when used with the carbon arc lamp on a continuous current and assures better results than if the Type A Kodachrome film for artificial

light is used. This is due to the fact that the carbon arc lamp as a source of illumination closely approaches daylight in quality. The newer Nordenson cameras are equipped with nitra lamps which would appear to do away with the contrast re-adjustment of the carbons that is necessary in the older models; however, the lamp gradually will become less brilliant because of the demands made upon its filament. This will necessitate a recheck from time to time of the intensity of illumination derived from the lamp in order to obtain uniform results with the latter.

The preparation of the patient and the selection of the type of eyes suitable for fundus photography already has been mentioned. It should be reiterated that the handling of the patient during the procedure obviously is an extremely important factor in obtaining not only satisfactory but excellent pictures.

Stereoscopic pictures undoubtedly are more valuable to the trained clinician than single flat photographs but the operator must acquire a complete and skillful mastery of the camera mechanism as well as a discriminatory appreciation of colors and contrasts not to mention a certain knowledge of the appearance of normal eyegrounds and possible morbid processes. The more general use of color photography of the human ocular fundus, whether single or stereoscopic pictures are obtained, should continue to be of increasing importance to the patient, clinician and the laboratory worker.

The author wishes to express his grateful appreciation for the assistance given by Mr. A. Marfaing in the preparation of the cuts. The reproduction in color of the retinal photographs was prohibitive in price. It was necessary, therefore, to produce black and white photographs from the original transparencies. The linear scratches observed in the cuts were caused by the film adapter. These do not appear on the screen when the color transparencies are projected.

Planning and Equipping for Biological Photography

by William L. M. Martinsen*

WHEN we speak of a small photographic laboratory, we do not necessarily refer to the amount of space given over to that department, nor even to the quantity of work done there. We are rather concerned with the appropriation voted for the purchase of equipment and for maintenance. The reason for this should be apparent without much reflection. A department with a limited budget will remain small in scope of work as well as in personnel, even though space may be plentiful. At the same time, many departments which might properly be termed large are housed in cramped quarters, due principally to improper initial planning. However, we will have more to say about this in a moment.

After an institution has decided upon the establishment of a photographic laboratory, it becomes necessary to consider the type and amount of equipment which is to go into that department. If the funds available are not sufficient for the purchase of special apparatus for the various tasks to be performed, then it becomes necessary to choose each piece with the greatest care. The various pieces must of necessity be called upon to perform more than one type of work. For this reason, the outfitting and designing of a small photographic laboratory demands much more forethought and ingenuity than the development of a large department where each phase of the work is performed on equipment especially designed for the task. The assembling of these various pieces of apparatus demands, first of all, a consideration of the various types of work which the department will be called upon to undertake, but the planning should not stop there. Experience has shown that, once established, a photographic department will be constantly asked to take on new and different assignments. If the equipment is carefully chosen, these demands can usually be met without resorting to large additional expenditures for apparatus.

It is true that one room which is to serve as a studio, plus another smaller space set aside as a dark-room, fulfills the basic needs of a small

* Presented at the convention of the Biological Photographic Association, Pittsburgh, Pa., September 1939.

From the Research Laboratories of the City of Chicago Municipal Tuberculosis Sanitarium.

department. When selecting the rooms to be occupied by the photographic department, the floor plans of the building should be studied and cognizance taken of such features as plumbing, electricity, ventilation, etc. At the same time, consideration should be given to possible future expansion. Adjoining rooms should be examined to determine whether or not they are suitable for photographic purposes, and also if they might be made available should the need arise. That sort of thing usually requires close collaboration and consultation with the executive offices, but can generally be worked out. Whether that extra space is at once incorporated into the department or simply left available, is immaterial, but the wisdom of planning for the future will sooner or later be appreciated. Even though the department was conceived solely for the convenience of obtaining certain records, its usefulness in other fields will soon be recognized, and the scope of the work will be constantly enlarged. Eventually the present quarters may be found to be too small for efficient work. If this contingency is provided for in the early plans, all is well. If not, the department may find that the only available rooms are some distance removed — perhaps even on another floor.

The amount and kind of equipment needed in a biological photographic department is largely dependent upon the particular work to be performed. It would seem, therefore, that it would be difficult to advise, except in a general way, concerning the choice of equipment. Fortunately, however, the photographic problems in the various branches of biology are not greatly foreign to each other, which simplifies our problem.

For the purpose of this discussion, we are dealing solely with work which may be performed in the laboratory or under related conditions, thus permitting the use of standard procedures. We are not concerned with field work which makes special demands upon equipment according to the nature of the work, and for which it is best to consult some of the many excellent papers which appear periodically in the various scientific and nature journals. Also, in order not to be caught in the dragnet of controversy over the relative value of the various items of apparatus available, we will confine ourselves to making recommendations. These will consist of such items of equipment as our experience has shown to be suitable and adequate for the pursuance of biological photography.

The first recommendation is the acquisition of a sturdy, well-constructed view camera of 5 x 7 inch size. The camera selected should have all the various means of adjustments such as a rising and falling lens

board, a horizontal and vertical swing back, and sufficient bellows extension to permit an image of natural size or larger. All of these are essential, and a camera possessing them is sufficiently versatile to take care of all copy work, close-ups of lesions or small objects, and gross specimen photography. With it can also be produced lantern slides, stereophotographs, and if needs be it can be coupled with a microscope for an occasional photomicrograph. The lens should be of anastigmatic correction and, where only one lens can be purchased, it should be of medium focal length — approximately 7½ to 8 inches. Such a lens will be more universally adaptable than one of longer focal length. At the same time, it is less expensive and fits well into the smaller budget. Additional savings may be made by choosing a lens of small aperture. Stops larger than f:8 are of little value in scientific photography. In fact, the author spent many years doing work with an f:8 lens and never lost a film for reason of lens aperture. Even now, with fast lenses the choice is invariably in favor of the smaller stops.

A strong tripod is indispensable to good work and should be part and parcel of every photographic department, regardless of size of budget. It should have facilities for easy rising and falling, and have a positive locking device to hold the camera at the elevation selected. It should also be fitted with a tilting top, adjustable to all degrees of tilt from horizontal to vertical camera position.

To provide a measure of efficiency in the department, it is necessary to add a contact printer for 5 x 7 inch films, and also an inexpensive set of developing and fixing tanks. Trays are of course necessary for certain types of work such as prints and lantern slides. The new stainless steel trays recently introduced should be considered. In this connection, it might be said that although the higher quality products may require a somewhat greater initial outlay of cash, they will in the long run be found to be the least costly, due to their greater ability to withstand wear and abuse.

Some equipment for lighting is indispensable for laboratory work, since it is out of the question to employ daylight for very much of the work. In most instances, three light units fitted with 500 watt lamps will take care of all the lighting problems encountered. For flexibility in lighting, these should be mounted on adjustable stands — extensible from two to about seven feet in height. Generally speaking, the lights selected should throw a fairly broad, even spread of light. An important factor to remember in connection with light reflectors, is that the manufacturer has designed them for use with a certain type and size of light bulb, and that for best performance of the lighting equipment, only

that particular lamp should be used. If a change is made to any other lamp it is necessary to adjust the new lamp so that the light filament is made to occupy the position originally intended by the manufacturer. If current consumption is a problem, as it indeed can be where only one electric circuit is present in the room, it is perhaps advisable that photo-flood lights be used rather than the high wattage incandescent variety. The photo-flood lamps are somewhat more expensive to use, but this cost is partly offset by lower current consumption and also by obviating the necessity for costly changes in the wiring system.

The numerous small items usually found in any photographic laboratory — film holders, safelights, ferrotype tins, etc., can easily be selected out of photographic catalogues, and need no mention here. Our concluding remarks will instead be directed towards showing how the few items of apparatus so far discussed may be used, or adapted for use, in the usual everyday undertakings of an average department. Methods of procedures stressing the role of the equipment in these procedures will be discussed rather than technics. The latter is outside the scope of this discussion, and is quite unnecessary because the literature contains many papers far more exhaustive on the subject of technic.

Copying, whether it be from radiograph or printed matter, can be done more satisfactorily on a work bench where the camera and copy easel may be exactly aligned and centered. The simplest form of a copy stand consists of a table with a place for mounting the camera at one end and the copy easel at the other. The latter may be made to move back and forth between two guide rails. When the camera is mounted on the stand, the lens should occupy a position exactly in front of the center of the easel, and it should maintain this position irrespective of the distance separating them. It is necessary that the easel be mounted perpendicularly to the table surface, and that the easel and the ground glass surfaces be perfectly parallel to each other. Adjustments for size of copy are made by moving the easel backward or forward before the lens. Focussing alone is done at the camera. In addition to serving for copy purposes, the copy stand is often useful for the photography of mounted specimens of various types. It is also an excellent arrangement for making lantern slides from intermediate copy films and other negatives. Reducing backs for the camera having plate holders of lantern slide size are available. However, a much less expensive and equally satisfactory solution is to outfit a pair of 5 x 7 inch double plate holders with reducing kits for lantern slides. These cost only a few cents and are obtainable everywhere.

The use of the camera for gross specimen photography is self evident, and needs no further comment. For small objects where the regular camera lens is unable to produce the necessary image size, the use of shorter focal length lenses is indicated. The micro tessars have long held a favored place for such work. Many workers prefer these lenses mounted in a rack and pinion focussing mount for final adjustment of focus. This, however, is optional. A great deal of the work may advantageously be done on the copy-stand, although some of it will require a vertical camera position. Where high power photomicrography, requiring the use of a compound microscope is part of the routine of the department, a photomicrographic unit is recommended for ease of manipulation. The smaller 5 x 7 inch units are entirely satisfactory. However, lack of such a unit does not preclude doing good work, for it is principally a convenience. However, a good lighting unit designed for photomicrography is recommended. The better of these is fitted with either a ribbon filament or a point-o-light bulb, and should have a focussing condenser in front of the light source. A set of light tight connectors for joining the camera with the microscope and also an extra lens board with a screw flange, threaded to receive the connector should be added. The entire apparatus should be carefully assembled on a heavy, narrow table. The centering of such a set-up naturally presents the greatest problem, because both camera and microscope serve double duty, and must be re-assembled and re-centered every time the equipment is used. The use of the Kelvin geometric slide principle for mounting optical equipment was suggested by J. E. Barnard in his book "Practical Photomicrography," and offers an excellent solution for this problem. By the use of this method, any or all parts of the set-up may be removed and returned to its place quickly and accurately.

The possibility of using the camera for stereophotography has been mentioned. This may be done without any further additions by way of equipment, but for speed and efficiency a sliding camera base should be constructed. This problem was discussed in a previous issue of this journal[1], and should be consulted for details of construction and manipulation.

The skill of the worker is paramount to the equipment. A good photographer will produce good work with a minimum of equipment.

[1] Martinsen, W. L. M., Stereophotography with Special Reference to Gross Specimens, J. Biol. Photog. Assn., 8:19, 33 September 1939.

Counting Seconds

by Anne Shiras*

EVERY so often an occasion arises for photographers to count seconds during exposure, processing, etc. Our members report various ways of doing it. The commonest is to say aloud "one-thousand-one, one-thousand-two," etc. Another, and more accurate count is "nought-one-half-and-one, nought-one-half-and-two" etc. A play written by George Bernard Shaw and called "In Good King Charles's Golden Days," contains a method of counting seconds that is a tongue-twister. Sir Isaac Newton is one of the plays principal characters, and Newton, (according to Shaw) counted "hackertybackertyone, hackertybackertytwo, hackertybackertythree" and so on. Try it for about sixty seconds! If you do, you will probably find it more accurate than other simpler methods. For it has this in its favor; it does actually take a second to say "hackertybackertyone" as quickly as you normally would without slurring the syllables. Whereas "one-thousand-one" can easily be said in three-quarters of a second or less. So that, though you usually start out slowly, you get appreciably ahead of the clock in 5 or 10 seconds, especially if you are doing other things at the same time. The same criticism is true, though to a lesser extent, of "nought-one-half-and-one." The seven syllables of the Newtonian method are a good curb, and the difficulty of keeping them straight, after the first few seconds tends to make you concentrate on the counting. If you do not like the sound of them, the best you can do is to invent others that have the same swing and take about the same amount of time to say. The chances are, after a few attempts, you will string along with Newton.

* Received for publication February 5, 1941 from Magee Hospital, Pittsburgh, Pa.

The Reproduction of Radiographs

by F. R. Harding*

ACCURATE copies of radiographs are one of the most difficult problems besetting the biological photographer. A brief summary of a few of these problems will possibly clarify some of the difficulties. The main problem in reproducing a radiograph is loss of tones during reproduction. Without resorting to some photography trickery, it is frequently impossible to avoid this loss for the following reasons:

Problem 1: Because the possible tone scale available in radiographic film is far longer than the tone scale available in photographic film. This is something which cannot be altered by the photographer—it is a problem for the manufacturer of sensitized material.

Problem 2: If an intermediate reproduction is made and from it a print is desired, it will be found that the scale of tones available in sensitized paper is even shorter than the scale of the intermediate film.

Problem 3: A radiograph is always viewed by transmitted light. For purposes of illustration it is often necessary that a radiograph be made in the form of a photographic print so that it may be reproduced in a journal or book. Illustrations of this kind are always viewed by reflected light. Here is one object, a radiograph, which must be viewed by both reflected and transmitted light. How then is the photographer to produce detail seen by transmitted light in a photographic print viewed by reflected light?

The answers to these problems, as far as they can be answered, are as follows:

Problem 1: A film with the longest possible scale must be employed. This information can be obtained from most manufacturers of photographic materials. The film must be developed with a formula that produces good shadow detail and does not plug up the highlights. Further along in this paper the writer will give his personal preferences for both film and developer.

Problem 2: A photographic print from the best possible intermediate or positive film will nearly always represent a compromise when it is compared with the original radiograph. By shading during the print-

* Received for publication November 4, 1940. Children's Hospital, Boston, Mass.

ing exposure and by proper choice of the grade of printing paper and developer an accurate print may be made, but it will not be an *exact* reproduction of the radiograph.

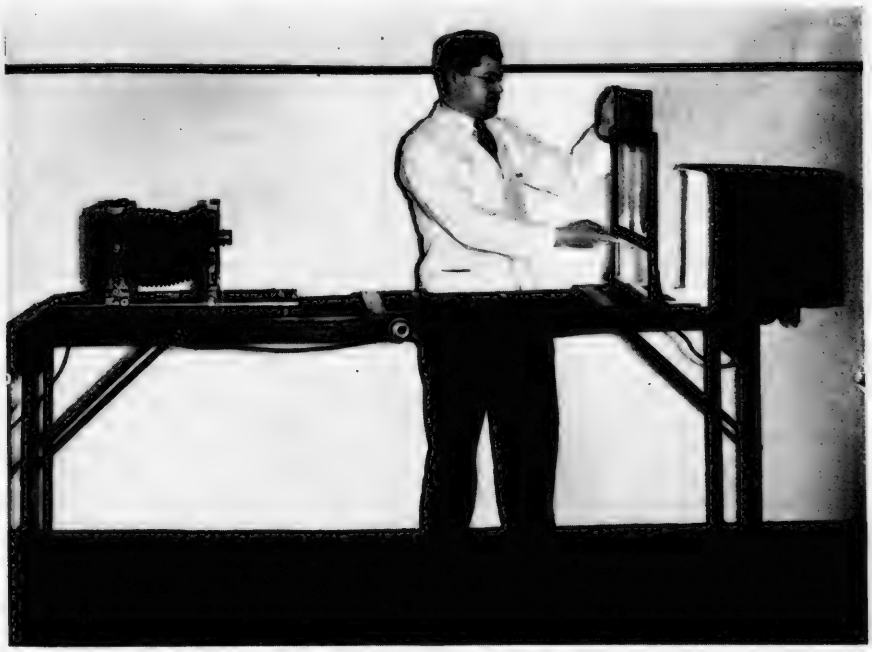

Figure 1. The apparatus employed by the writer for reproducing radiographs.

Problem 3: This problem is closely allied with problem 2, and in part, the answer to problem 2 holds good for problem 3. In addition, however, the most nearly true reproduction is produced by a lantern slide. The lantern slide emulsion does not have a tone scale nearly as long as either radiographic or photographic film, but the scale is longer than that of photographic printing paper. Further than this, being viewed by transmitted light, it more nearly approximates the radiograph. Expert manipulation of the lantern slide during exposure and development will result in a very creditable reproduction.

There are several important factors which influence the production of good radiographic reproductions. One of these is even distribution of light on the radiographic film. If the light is not even over the entire film, difficulty will be experienced in making prints or lantern slides. Even distribution of the light can be checked by the use of a photronic or photo-electric exposure meter on the radiographic film holder when

it is empty. Another factor is the squaring or leveling up of the light source, the radiographic film holder and the camera. The camera and the film holder must be parallel, or vertical lines in the radiograph will converge. This is to be avoided at all costs. Another important factor is correct exposure. Always employ an exposure meter and remember that, in all probability, the radiograph is being photographed at a distance which is less than eight times the focal length of the lens being employed. When this is true, the indicated aperture or stop (that stop to which the diaphragm is actually set) is not the same as the effective aperture or stop, which is the stop which actually applies for purposes of computing exposure. The Effective Lens Aperture Kodaguide, made by the Eastman Kodak Company is an excellent reference in making this computation. Do not fail to take this matter into consideration when radiographs are being photographed. The most important factor of all is the film and

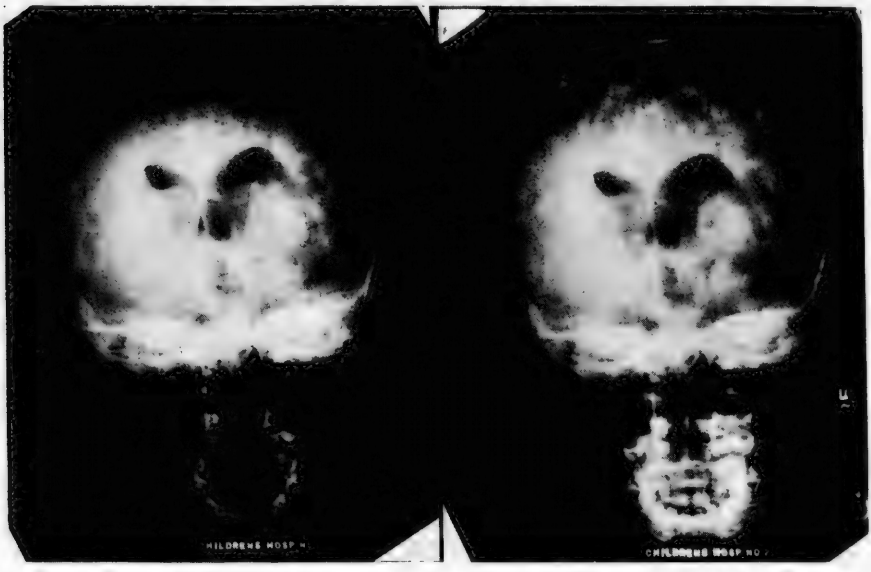

Figure 2. The reproduction on the left was made with only the primary exposure. The reproduction on the right, of the same film, was made by introducing the local light after the primary exposure had been made. The skull outline, the jaw, and the date were treated.

developer that may be employed to get the best possible results. The writer prefers, for all ordinary routine procedure, Eastman Ortho X Film. It has a long scale of tones and is developed in DK 60A to a moderate density. It has a fast emulsion which means that exposures are usually

short. This becomes important when many radiographs must be photographed, as time is saved. Some of the fast hyperpanchromatic emulsions also have a long tone scale and would undoubtedly produce good intermediate films. Occasionally a very poor, flat radiograph is photographed on a process emulsion in order to increase the contrast to a point which will reproduce well.

Having discussed some of the main problems involved in reproducing radiographs, it would appear necessary to describe the apparatus involved. More than one type will be considered, keeping in mind the number of radiographs which will be produced per month. Obviously, if quality is a secondary consideration and one or two films per month are to be photographed, the most elementary apparatus will serve. The simplest apparatus would consist of the camera and tripod usually employed for clinical photography and a regular 14x17 inch radiographic illuminating box. The camera and box must be aligned so that the lens board and the radiograph are exactly parallel. If the alignment is not correct, the reproduction will have converging lines. The light source in average illuminator is not brilliant, and this necessitates relatively long exposures which waste much time if many films are to be photographed. When the illuminator is employed, it is not possible to manipulate or shade the light effectively to compensate for widely varying densities in the radiograph. This method is only recommended when a small number of films are to be photographed. Another apparatus utilizes a large illuminating box which is primarily designed for the photography of gross pathological specimens. This idea is good because it cuts down the amount of apparatus in the photographic department. Essentially it consists of a large box painted white inside and employing indirect lighting inside the box. There is some control over the lighting as the lamps are grouped for control by several switches. This is of some aid when radiographs are photographed, but the dimming effect is rather broad for the purpose being discussed. The camera rides a vertical slotted board containing a tripod screw. The slotted board is fastened to the illuminating box so that the camera is centered over the glass top. Black paper masks must always be used with the radiographs so that no free light is emitted. A mask must be cut for each size of radiograph and its outside dimension must equal the dimension of the illuminating glass. This holds true no matter how the radiographic copying apparatus is constructed. The apparatus described above is reasonably efficient, but still does not allow complete control of the light to compensate for the widely varying densities found in some radiographic films. Some control is possible by using black cards containing holes of various sizes and shapes. One of these cards is held close to the radiograph and is designed to

block off all but the dense areas needing more exposure than the overall exposure computed with an exposure meter. The extra exposure frequently is rather lengthy. The black card must be given a vibratory

Figure 3. Radiograph of a pelvis. The local light is used on the left and right side to bring out the margins of the ilium.

motion in order to avoid a semi-sharp line along the edge of the hole in the card.

The writer devised an apparatus some ten years ago, which overcomes some of the objectionable features which have been mentioned in this paper. There is no thought in mind that this is the best apparatus for copying radiographs, or that it is not possible to improve upon it. All that can be said is that it permits rapid and reasonably accurate reproduction of radiographs. There are many other designs for apparatus of this type which are just as efficient. The apparatus is simple in construction. It consists of a skeleton top stand, waist high, 6 feet long and 15 inches wide. On this are placed two moveable platforms. The platforms have a ½ inch square guide fastened on the under part, at each side. This allows them to be moved back and forth without getting out of square in relation to each other. One platform is placed at each end

of the stand. The right hand platform has a suitably braced, square "U" shaped frame fastened to it. This frame has a ¼ inch square groove cut in each upright. This is to accommodate the glass "sandwich," which is a sheet of plain and a sheet of white opal glass, 14x17 inches in size. In use, the opal glass is placed toward the light source. The radiograph and its black mat are inserted between the glasses. The sheets of glass are hinged at the top with adhesive tape. Fixed to the right hand end of the skeleton frame is an electric lamp socket containing one 500 watt lamp. A rectangular housing encloses the lamp and may be of any type as long as it helps to produce even illumination over the glass, and prevents stray light from getting into the room. If stray light is permitted, it is liable to reflect from some object in the room onto the front surface of the glass. This would cause ghost images to appear on the radiographic copy. The left hand platform carries the camera which is an ordinary 5x7 inch view camera employing an 8½ inch lens. The apparatus is installed in the processing room. No light in the room except the lamp in the apparatus should be on during focussing and exposure. The lens is always used at stop F:16 and the exposure is determined by photronic exposure meter. As there is an open space of about 14 inches between the lamp house and the back of the glass "sandwich," much control is possible. Certain types of radiographs, such as anterio-posterior and posterio-anterior skull plates, laterals of spines, particularly those showing a severe kyphos, and certain chest plates showing a great variation in density between the right and left lungs, have such a great variation in density that it becomes necessary to introduce more light in those areas if a satisfactory reproduction is to be produced. This is done quite simply and rapidly by what the writer calls a "local light." It is employed as follows:

The radiograph is set in place in the apparatus and the exposure meter is used to determine the exposure of the normal portion of the film. After this exposure is made, the regular lamp is turned off and a previously prepared "local light" is employed. This is a 100 watt lamp contained in a wire guard such as is used with "trouble" lights or garage extension cords. The wire guard is covered with any opaque, fire resisting material. The outer end is left open. A heavy black paper mask is fastened over this end. The opening in the mask is made the correct size for the area to be locally exposed. Very large openings are not desirable. The ideal solution would be an iris diaphragm, which would allow complete control of the size of the opening. Having decided on the proper size of opening in the mask, the "local light" is turned on and held close to the back of the glass "sandwich" which contains the radiograph. Observation of the front or camera side of the glass will show when the

light is in correct position. The shutter of the camera is again opened, and the "local light" is kept in constant motion over the dense area which is to be locally exposed. Care must be taken that the light does not overflow into areas of normal density. When large areas such as the skull outline are being treated, the lamp is made to pass back and forth over the dense areas. Some experimenting will be necessary to determine the additional local exposure required when this device is employed. Excellent results may be had after a little experimenting. About sixty percent of the radiographs photographed by the writer are treated by this "'local light," sometimes only to make a badly fogged date on the film visible.

This apparatus is also employed when it is necessary to include radiographs in medical motion pictures. The only change made in the apparatus is the substitution of a 1000 watt lamp for the usual 500 watt lamp. Very good results have been obtained in this manner.

If radiographic reproductions are to be made in the form of transparencies, the best results will be obtained by projecting the intermediate film back onto radiographic film. By making the transparencies in this manner, a longer tone scale, and hence a better reproduction is produced.

First Medical Meeting of The National Foundation for Infantile Paralysis

The National Foundation for Infantile Paralysis held its First Annual Medical Meeting at the Waldorf-Astoria Hotel, New York City, on November 7 and 8, 1940. Attending the meeting were the members of the medical advisory committees, the grantees of the Foundation, and the Board of Trustees. Reports of the activities of committees and grantees for the preceding year were presented, and recommendations were made for grants for 1940-1941.

The Foundation is concerned with promotion and furtherance of research on all phases of infantile paralysis. Studies are being carried on through grants from the Foundation on problems of epidemiology, virus research, relationship of nutrition to poliomyelitis, and the prevention and treatment of the disease. In addition, a program of professional and lay education has been promoted.

A Fully Automatic Camera for Close-up Kodachromes

by Gustav Bucky, M. D.*

CERTAIN difficulties which make the task of the amateur interesting and enjoyable are quite disturbing and undesired in the work of the professional and especially the medical photographer. Artistic and technical photography treat details in a different manner. The artist emphasizes or diminishes certain details according to the necessity for a desired impression;—whereas technical reproduction demands photographic truth and exactness. Ways and means must be selected accordingly but differ in both cases.

The camera, described in this article, does not aspire to serve artistic purposes, but is destined for colored close-ups for medical and similar photographic problems. In this field great technical obstacles exist which not only require an elaborate outfit of special stands and lighting, but can only be overcome by painstaking and time absorbing labor. If the inside of tubular objects or cavities have to be photographed, then difficulties grow, and sometimes become invincible, for instance when a suffering patient is the photographic object. The camera eliminates all these difficulties; its outstanding features are the following:

One unit, no other paraphernalia
No focusing
No light adjustment
No settings
No studio
No loss of time
No transportation or removal of object
Photographs can be taken at any time in any location from any living or lifeless object.

The requirements we set up for the apparatus are:

Constant Light Source

Proper illumination of the object is of main importance for satisfactory results. Our first attempts were made with flash bulbs. Very soon, for several reasons, we abandoned this kind of illumination. In Kodachrome, a flash bulb always causes a bluish

* Received for publication January 14, 1941 from 5 East 76th Street, New York, N. Y.

tint which is disturbing especially in medical objects. It is also unpleasant to carry a number of bulbs especially if the pictures must be taken from an object which cannot be brought to the studio. The cost of a flash bulb for each shot appeared to be prohibitive. We therefore employed the flood light. After many experiments we were able to obtain a bulb with the proper color temperature and intensity of a size small enough to be incorporated in the camera proper. The life time of this bulb is long enough to reduce the cost of the individual shot to a fraction of a cent (The price of a flash light bulb is not less than ten cents.) At least 1000 shots can be taken with one bulb. This bulb can be connected with any line of 110-120 volt tension. Small differences in tension are hardly noticeable in the quality of the pictures. It is understood that considerable voltage drop will affect quantity and quality of the light and in such cases voltage stabilizers must be used. However, such a procedure becomes necessary only under extreme circumstances just the same as with ordinary flood light bulbs. The bulb should not burn any longer than necessary because of the overload of the filament essential to obtain the proper color temperature. No filter for color correction is necessary.

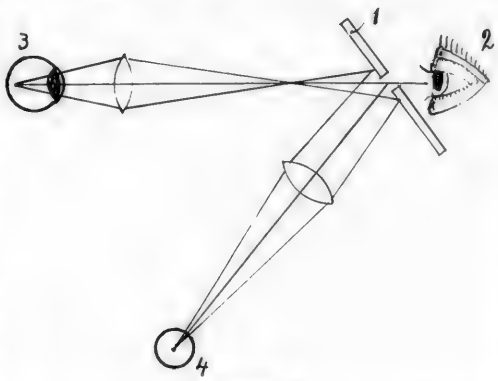

Figure 1

It was not easy to obtain the required light intensity with a bulb small enough to be installed within the casing of the camera, but one of the essential points was to have the light source as close to the lens as possible. For color pictures the light should be distributed evenly to avoid dark shadows as the color quality is dependent on light intensity. To reduce the size of the bulb we collected the emitted energy by a double lens collector similar to those in projectors. In fact, the size of the bulb was reduced to that of a 750 watt projector bulb, but its emission was approximately that of a 1750 watt bulb multiplied by about 4, because of the condenser system. With such an intensity it was possible to meet the requirements for medical color photography and related subjects.

The experiences of 2 years have shown that our light source is highly reliable in all the respects mentioned above.

Illumination Adjustment

For technical and medical photography, the axis of the illuminating light beam should coincide with the axis of the lens in most of the

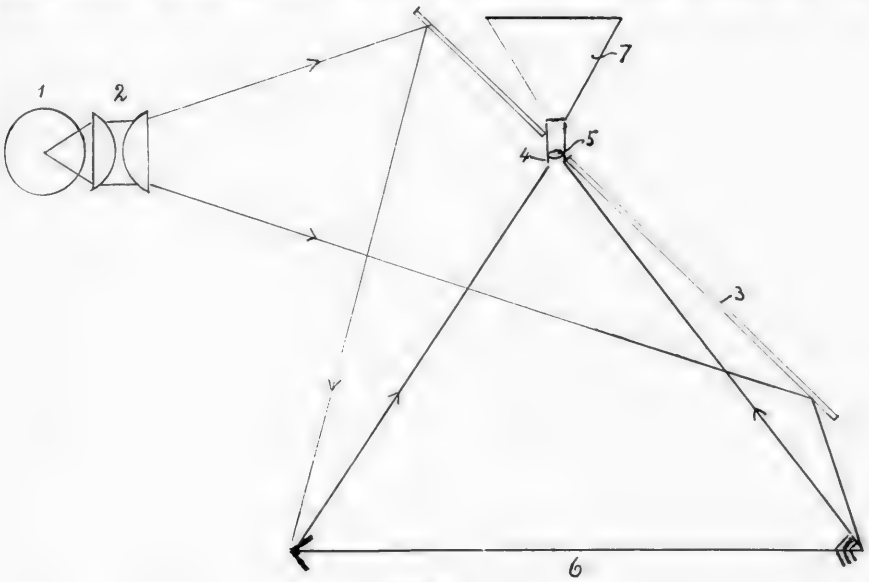

Figure 2

cases. This statement is the outcome of our experiments. In a few instances, this kind of illumination is disturbing, especially when working with highly reflecting surfaces in an exact rectangular position to the light axis, as in oil paintings, glossy prints, and similar objects; such lighting is not good for artistic effects. Aside from these few instances, the lighting system as constructed in the camera, has been proven very satisfactory. It produces photographs of high quality, and enables the unskilled layman, without experimentation and preparation, to take color photographs of cavities which give headaches even to the well trained and fully equipped photographer. No matter how often one snaps a difficult picture, the speed and simplicity of this procedure is always a surprise, especially when the eye, mouth, nose, ear or vagina are to be photographed. Constancy of illumination is a requirement for technical and medical photography. In artistic

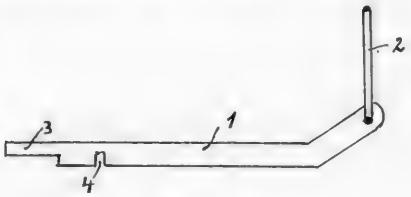

Figure 3

photography, individual factors and conceptions play a decisive role allowing several equivalent solutions of the same problem. In technical and medical photography, there exists an optimum concerning lighting and position. Therefore, standardization is possible and advantageous.

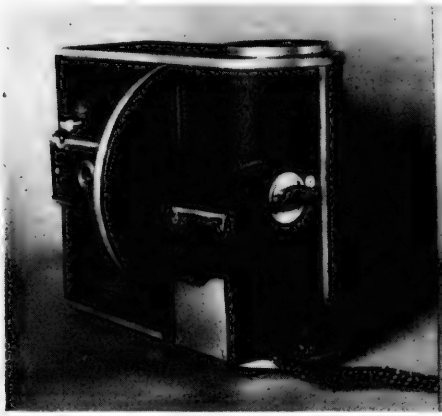

Figure 4a

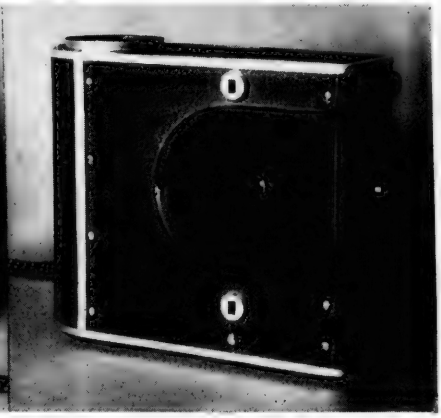

Figure 4b

Construction of Camera

General arrangement: One of the main problems was the arrangement of the light source so that the optical axis of light beam and lens coincides. For this purpose, the principle of Helmholz' eye mirror was used in which a light reflecting mirror, 1, figure 1, carries a hole in its center through which the eye of the observer, 2, looks at the eye of the patient, 3, the light of the candle, 4, is reflected from mirror (1) into the eye (3) of the patient. This arrangement is necessary to visualize the retina of the human eye. In animals, the light illuminates the retina more easily which can be observed at night, when the strong head light of an automobile shines in the eyes of cats and dogs. As the camera arrangement illuminates the eye, the pupil appears red in the colored pictures, which represents the color of the retina. It is obvious that the light arrangement illuminates cavities free from shadow, even if the opening is smaller than the background. It is, therefore, ideal for many technical and medical subjects.

In figure 2 a schematic drawing indicates the construction: (1) and (2) is the light bulb with the condensers, (3) is the mirror which reflects the light emitted from the bulb to the object (6). Behind the hole (5) of the mirror (3) is the lens of the camera (7). The lens shade (4) prevents the light of the bulb from striking the lens. The mirror (3)

can be turned a few degrees on its middle axis. This movement is provided for color photographs of the eye, especially in diseases of the cornea, when the pupil should not appear red.

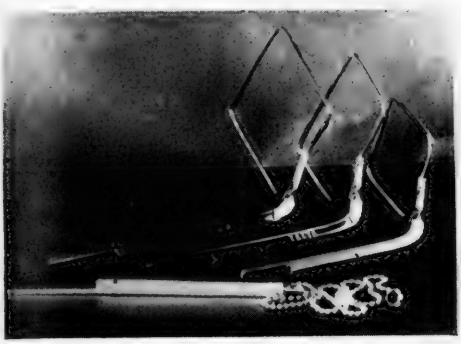

Figure 5

Automatic focusing: centering, and diaphragm adjustment: From the view point of a living object, the arrangement of light and camera is the most disturbing feature of the photographic procedure. Having medical purposes in mind, we endeavored to eliminate this procedure entirely. Focusing not only includes the setting of the proper distance from lens to film but also the size of the picture which depends on the object and lens distance. For a certain object, one size of reproduction is optimal, and there is no necessity for variation. Consequently, rigid distance pieces can be used once and forever. By accepting this premise, the focusing of the lens becomes likewise fixed, as there is only one setting of the lens for a given distance from the object. Furthermore, if the light source is kept constant, only one diaphragm opening must be used, which always remains the same for the object in question. These three premises can be combined technically in one part as illustrated in figure 3. (1) Is a metal rod which carries the field frame (2) on one end, indicating the size of area to be photographed. The opposite end is cut to half the thickness and sets the diaphragm (4). A "notch" which keeps the rod in proper place after the camera end has been pushed backward for proper focusing. In this way one simple member insures object-lens distance, lens-film distances, centering of object, and proper diaphragm.

Aspect of Camera

In figure 4, back and front views of the camera are reproduced. Figure 5 shows a set of focusing brackets. The bracket used for the outer eye moves the reflecting mirror a few degrees around its axis, so that the pupil appears black. This movement is automatic when the bracket is inserted.

CHATS WITH THE EDITOR

"Ex Cathedra," editorial column of the BRITISH JOURNAL OF PHOTOGRAPHY, Friday, October 11, 1940, after reviewing the announcement of the Milwaukee convention and the purposes of the Biological Photographic Association, comments as follows:

"There is, of course, nothing unusual in a discussion, or even a convention, on some sphere of photography, with its attendant trade show, while at the same time there can be few scientific workers of any standing who do not fully recognize the fundamental value of photography to almost any branch of science that one might care to name. But it is, we think, less common to find a live society that exists solely for the utmost exploitation of photography in the service of one particular branch of science, regarding the photographic side as of equal importance with the scientific side—indeed so far as their society is concerned rather of predominating importance, since its name describes it as a photographic association albeit biological. We have in the past frequently expressed regret that so often photography is regarded not so much as a co-equal collaborator, but as the slave, of the sciences. Here is a different atmosphere, and one which we should like to see spread throughout all science and technology so that it must soon become impossible for photography any longer to escape recognition not merely as a subject, but as a full faculty—on equal footing with chemistry, physics, biology, and the like—in all seats of learning. It should then very soon be found that it is indeed an all-embracing faculty, with tentacles spreading throughout science; to the end that the trained and qualified photographer will become a key man throughout science and industry by virtue of his wide grasp of the subtleties of the multifarious services that photography renders, and of the niceties of its application in their rendering."

CURRENT PHOTOGRAPHIC ABSTRACTS

The Army Trains Aerial Photographers. E. Bruguiere. *Photo Technique*, 1:4-9, July, 1939. Nine months of severe training are required for the U. S. Army photographic course; of about 5000 men who take the entrance examination, only about 120 are admitted, and of these, only about 75 pass the final tests. Many different branches of government work are served by the photographers thus trained. The essentials of aerial photography are accuracy, reliability, and speed. Knowledge in the use of many cameras is required. The case history of a typical flight is described with reference to the selection of filters, cameras, and type of plane. The problems encountered when flying at high altitudes are detailed. The preparation of mosaic maps is described briefly. The problem of turning out a complete aerial map on maneuvers is discussed for an unknown area of 3,000 square miles. Three planes working 3½ hours morning and afternoon can complete the photography. Ground crews using two developing and four printing trucks make the prints. The complement of two trucks is 2 officers and 20 men. Providing that there is only one hour's delay in getting the first negative and that subsequent rolls come in regularly, the map of 3,000 square miles can be completed in less than 19 hours. G. E. M.

Direct Photography in a Miniature Ultracentrifuge. J. W. McBain and A. H. Lewis. *Science*, **89**:611, 612, June 30, 1939; *Brit. J. Phot.*, **86**:630, Oct. 13, 1939. A photographic record which shows optical inequalities in the suspension during centrifuging is obtained by exposing a strip of film, through the tube carrying the suspension, while the centrifuge is still operating. E. W. H. S.

The Photography of Fine Dust Particles. D. G. Beadle. *J. Sci. Instruments*, **16**:262-63, August, 1939. By careful choice of illumination conditions, magnification, and photographic technique, it is possible to reveal nearly twice as many fine dust particles as can be observed visually under the best conditions. E. W. H. S.

Photomicrography of Insects. A. J. Iorio. *Photo Technique*, 1:32-7, July, 1939. Detailed instructions are given for preparing the specimen without damage; for mounting it on a glass slide, using Canadian balsam; and for photographing it, using a view camera. The specimen-bearing slide is carried on the stage of a dissecting microscope, and the view camera, positioned vertically above the stage, is raised or lowered by adjustment of the x-ray stand to which it is attached. Details are also given on correct lighting, exposure, and development. C. J. K.

News From the Trade

Eastman Kodak Company Announces a New Miniature Camera

Heralded as "the world's most distinguished camera," with points of superiority over every other top-bracket camera in the miniature field, a de luxe 35mm. camera, the Kodak Ektra, is announced by the Eastman Kodak Company, Rochester.

For this camera, six interchangeable lenses are announced, incorporating new optical technics which insure high quality performance. Focal lengths range from 35mm. to 153mm., with other lenses to come, and a program of fine accessory equipment is also planned.

A distinct departure in miniature cameras, the Kodak Ektra is the first to provide both interchangeable lenses and interchangeable Magazine Backs for 35mm. film. These Magazine Backs enable the Ektra owner to switch from one type of film to another in the middle of a roll, quickly and without loss of a single frame.

Other outstanding features of the new Ektra include:

1. The most precise range finder on any miniature camera, coupling automatically with all focal lengths of Ektra lenses, and equipped with an adjustment for individual vision.

2. A focal plane shutter of unique precision and stability of performance, with speeds from 1 second to 1/1,000, and "bulb."

3. A variable-power view finder which sets by a simple dial for lenses of focal lengths from 50 to 254mm., corrects automatically for parallax, and has an adjustment for individual vision.

4. A rhythmic operating cycle for all major adjustments, with all operating controls at the finger tips of one hand, and the other hand free for gripping camera.

5. Full visibility of all scales and dials from the top of the camera (including the direct-reading depth-of-field scale and aperture scale on most of the lenses) so that all operating data are available at a glance.

6. Rapid film advance and rewind, with a visible indicator actuated by the film itself—providing a sure and accurate check on film movement. Advancing the film simultaneously resets the shutter for another exposure.

7. All control dials designed with a distinctive milled edge for rapid, convenient manipulation, and marked in large, clear numerals.

Lenses announced for the Kodak Ektra are all Kodak Ektars, all coupling automatically with the Ektra range finder for critical focusing, and all in mounts finished to harmonize with the camera. These Ektar lenses for the Ektra are surface-treated by a process that improves the clarity and brilliance of the negatives obtained. The surface-treatment process increases the efficiency with which light is transmitted by these lenses.

News from Bell & Howell

Completing the Bell & Howell line of 16mm. projection reels is the new, 2000-foot spring-reel recently introduced. The B&H line now includes 400-, 800-, 1200-, 1600-, and the new 2000-foot reels, all of spring-steel. The newest addition will permit an hour's continuous projection of sound film, an hour and a half of silent film.

Flexible, sturdy, rust-proof, light in weight, and "touch-threaded," the big, new reel may be used with sound projectors as well as with the larger 16mm silent projectors.

The Bell & Howell announcement states that a 2000-foot humidor can, cadmium plated to prevent rust, is available for the new reel. The film title may be written anywhere on the can without using a paper label, and the "tell-tale" disk of the humidor pad is an added convenience in indicating visually when moisture is required.

Bell & Howell announces the addition of a fifth speed to the Filmo Auto Master (Turret Head), and the Auto Load Speedster, B&H 16mm. magazine loading cameras. This new speed is 24 frames per second or "sound" speed. Films taken thus may have a sound track "dubbed" in later, and since all 16mm. sound projectors operate at 24 frames per second, the action in the picture is, of course, perfectly natural. Twenty-four speed is also ideal for slowing down rapid action to a degree more pleasing on the screen, action such as a pole vaulter rising to clear the bar, kittens at play, etc.

This new speed gives these B&H cameras a speed range of from 16 to 64 frames per second. There are now five speeds—the normal 16-speed, for general use; 24-speed, for sound to be added later; 32-speed, for shooting from moving vehicles and for fast action shots; 48-speed, for semi-slow motion; and 64-speed, for beautiful, analytical slow motion study.

News from Agfa Ansco

In keeping with the progress marked in other fields of photography, a new High-Resolving Sound Recording 16-mm. film has been introduced

by Agfa Ansco which should go far to advance the standards for high-quality sound reproduction in 16mm. motion-picture work.

The sensitive coating of this new film is made by a new process of emulsification which results in an emulsion structure of unusual homogeneity and uniformity of crystal size. This insures clean, sharp resolution of the sound track recorded on the film with a blue-filtered exposing light. In order to prevent deep penetration of the blue light into the sensitive layer, with its accompanying diffusion and halation through inter-crystalline reflections, the emulsion is screened with a water-soluble dye. This screening effect fulfills the double function of assisting in creating a surface image and preventing deep penetration of light into the emulsion layer, even with over-exposure.

This principle of obtaining a surface image is similar to that employed in 35mm. motion-picture sound recording where "ultra-violet" recording has been adopted to obtain highest quality sound reproduction. Although well suited for 35mm. work, ultra-violet recording technique has not been so successful when applied to 16mm. equipment because of light-limiting factors imposed by the ultra-violet filter, smaller optical systems and light waves. Accordingly, the common "positive" type emulsion has been in general use for 16mm. sound recording.

The special properties of the new Agfa High-Resolving Sound Recording Film make it an ideal material for variable area recording equipment, especially when differences between "crest" and "base" illumination are great. With ordinary positive film used for this purpose, it is practically impossible to put enough light through the valve to obtain clean "crests" of printable density without causing the "valleys" to become filled with the combination of inter-crystalline reflection and halation, due to over-exposure. The new Agfa High-Resolving Sound Recording Film overcomes this limiting factor by enabling the recording of high frequencies with a clean, crisp wave from having fully exposed "crests" and open "valleys."

It is not practical to give exact resolution data in terms of frequencies since much depends upon the recording equipment and the way in which it is being used. Optimum resolution is obtained when a filter transmitting between 4000 and 4500 Angstrom Units is employed with the exposing light. With recorders having insufficient light for a filter of these characteristics, a lighter-blue filter having transmission in the blue-green can be used with some sacrifice in resolution. Even when employed with regular, unfiltered incandescent illumination, the new film produces much cleaner sound tracks than are obtainable with ordinary positive film.

News from E. Leitz, Inc.

For viewing 2 inch square glass slides, Kodachrome transparencies in Ready-Mounts, and 35mm negatives or positive film strips, a new Desk Viewer has been placed on the market by E. Leitz, Inc., New York, N. Y. The lens supplied with the Viewer is a three-element achromatic objective which enables the transparencies to be seen sharply and without any distortion of the color in the original. A focusing mount provided with the objective permits variable magnification to be had.

Slides vary in density and in order that individual slides may be viewed to their best advantage, the Leitz Desk Viewer is provided with a rheostat. This permits the intensity of the illumination to be increased or decreased so that each slide may be viewed properly. The Viewer also imparts to a slide, a three dimensional effect which greatly resembles a true stereoscopic picture.

Slides are conveniently changed in the Leitz Desk Viewer through a "sliding track." It is supplied in two different finishes—light buff with black, and dark maroon with black.

A new pamphlet has been issued by E. Leitz, Inc., which describes the popular Leitz VIII-S projector.

Another Leitz pamphlet just off the press describes the Models V and VI Synchronized Flash Units.

The Leitz Polarizing Filter: Photographers are realizing that this type of filter can serve many useful purposes. It can be employed as a variable density filter to control the tone in which the sky is reproduced. In color work, this is extremely important for it can be used to darken the blue of the sky without affecting the colors of other objects in the scene. The polarizing filter is also used to greatly reduce surface reflection, on objects, permitting more detail to be recorded.

In use, the Leitz Polarizing filter is secured to the lens through the clamping mount. The Polarizing filter is then swung up to place it above the lens. The scene is viewed through the polarizing filter, from above the camera, the filter being rotated until the desired results are produced. After that, the filter is swung through 180 degrees, which places it in front of the lens, in the same relative position as when it was adjusted visually. Guesswork in the placing of the filter correctly in front of the lens is entirely eliminated.

Utilo Focusing Aid

A new focusing aid for the enlarger is called the "Utilo Focusing Aid." With openings so designed that when it is in place over the enlarger lens, two images appear if the enlarger is out of focus. As focusing be-

comes sharper, these images come together; when in exact focus, the images coincide. With this new device unsharp enlargements become a thing of the past. Further information about the "Utilo Focusing Aid" may be obtained from R. P. Gargille, 118 Liberty Street, New York City.

Multiplex Lantern Slide Cabinets

The Multiplex Display Fixture Company of St. Louis, Missouri, manufacture the Multiplex all-steel lantern slide cabinets. These cabinets combine a safe storage place for the lantern slides with a diffusing device so that the rack of slides may be pulled out from the cabinet and viewed without further handling. Capacity of various models vary from 240 3¼x4 inch slides to 1200 3¼x4 inch slides. Cabinets may also be obtained for 2x2 inch slides with a capacity from 720 to 3600. The cabinets may be combined to take both 3¼x4 inch and 2x2 inch slides. This would seem to be an ideal method of storing lantern slides.

Mirotex Water Filter

The Mirotex Products Company of St. Louis, Mo., generally known for the manufacture of amateur movie equipment has placed on the market a water filter for photographic purposes which has no replaceable parts and will last a lifetime. It is cleaned by simply reversing the filter unit and flushing. Installation takes about one minute; just remove the faucet, attach the filter housing to the pipe and replace the faucet on the front of the filter. The filter unit is a rigid disc of fine grain porosity which collects suspended matter as the water flows through. It is obtainable in different sizes and also for substances other than water.

Association News

FLASH!

DEAR COLLEAGUES:

"LET'S HAVE ANOTHER PHOTOMICROGRAPHIC COMPETITION!" WAS THE CRY AT THE LAST CONVENTION. I WILL DO MY PART BY GETTING TWO TISSUE-BLOCKS AND CUT TEN SERIAL SECTIONS FROM EACH, INDICATING THE AREA TO BE PHOTOGRAPHED, ACCOMPANYING EACH WITH A SIMPLE DRAWING TO SHOW THE COMPOSITION OF CELLS, ETC. I WILL MAIL THEM TO TEN DIFFERENT MEMBERS AND NON-MEMBERS BY MARCH 15TH.

THE PRINTS SHOULD BE ARRANGED ON 11 *x* 14 INCH LIGHT COLORED MOUNTS LABELLED WITH NAME AND INSTITUTION ON THE BACK. FURTHER INFORMATION WILL BE SENT WITH THE SECTIONS.

SEND REQUESTS TO ME IMMEDIATELY.

LET'S MAKE THIS A REAL COMPETITION!

VERY SINCERELY YOURS,

HENRY W. MORRIS
PHOTOGRAPHIC LABORATORY, MAIN CAMPUS
UNIVERSITY OF MINNESOTA
MINNEAPOLIS, MINN.

ASSOCIATION ACTIVITIES

Exhibit for the A.M.A. Meeting. Our members at the Milwaukee Convention decided that if possible we should participate in the scientific exhibit of the American Medical Association to be held in Cleveland, June 2-6. They suggested a booth showing the types of photography available to doctors in various fields of medicine, and stressing the standards which make pictures suitable for records, publication, exhibits, etc. We do not know definitely whether space can be obtained. If it can be we will begin, in March, to collect material for our booth. We will arrange to have a member in the booth at all times, qualified to answer questions on the procedures of medical photography. Will all those who have suggestions or material to contribute write to the Chairman of the Public Relations Committee, Dr. Arthur Proetz, 3720 Washington Boulevard, St. Louis, Mo., or to the Association Secretary, Miss Anne Shiras, University office, Magee Hospital, Pittsburgh, Pa.? Prints, lantern slides and transparencies, in black-and-white and color are eligible. Photographs will be credited to the photographer and his institution. They will be returned shortly after the meeting. This is our last oppor-

tunity to invite the membership at large to contribute. If you are interested, get in touch with us and we will let you know whether we will hold the exhibit, and keep you posted on its progress.

Competitions. The X-Ray film is still making the rounds of photographers who are copying it for the competition, begun last year. The results will be shown at the 1941 Convention. Mr. William Payne, 149 Stockbridge Street, Buffalo, N. Y., is in charge. All X-Ray competition prints and slides should be sent to him.

Another competition is also under way, this time dealing with photomicrographic material. Details are given elsewhere in this issue.

Albums. Our albums are available to members for the cost of transportation one way. The subjects include clinical photography, research medical photography, photography of the eye, and plant photography. We hope to have other subjects soon. At present the albums are on the west coast and from there will be routed home via the western and northern middle-western states. For further information write to Mrs. Florence Melvin Coe, Department of Medical and Surgical Research, Ohio State University, Columbus, Ohio.

Salon. The 1941 Print Salon is available for the cost of transportation one way. It is suitable for hanging at scientific institutions and meetings, and may be obtained by writing Mr. Louis Schmidt, Rockefeller Institute for Medical Research, 66th Street and York Avenue, New York, N. Y. Ninety-four mounts 16x20 inches are included; 20 mounts 12x16; 7 transparencies 7x9 inches. Four prints are in color. Medical subjects predominate, but botany, natural history, etc., are also represented.

When exhibiting the Salon it is of course optional whether all or only a part is used. The Association would appreciate having their poster displayed and their accompanying leaflets given out to all who seem interested. The Salon has two trips scheduled during March, one to Fulton, Mo., and one to Lynchburg, Va.

SAFE-GUARDING EQUIPMENT

The market for optical equipment must be good now, judging from the number of thefts that have been reported. Three institutions in one city have lost photomicrographic equipment during the past two years. A west-coast member writes: "I am an ex-medical photographer, or rather a photographer with the inclination but without a camera. Someone broke into my laboratory and stole every bit of my worth-while equipment, leaving me only a few worthless gadgets. I lost my f 2.9 press camera, my movie camera with four valuable lenses, a new reflex cam-

era with tubes for surgical work, tripods, light meters, extra lenses for 5x7—in fact, my whole business that I had been eight years in paying for. I had built a fine laboratory and dark-room at my home as I used to be cramped for space at the hospital. Now I wish I had retained my quarters at the hospital, but I never dreamed of any burglar coming out to the country to steal photographic equipment."

The fact is that thieves are getting educated to this work; they will go anywhere for good equipment and when they get there, they will take the best. They have been known to strip a department of its apochromat lenses, and leave the achromats scornfully behind. Moreover, they elaborate rackets which gain them admittance to protected laboratories. A man in a middle-western city posed as a new doctor from the east, about to start a clinic. He called on photographic departments in various institutions saying that Dr. So-and-so (usually the chief of staff) suggested his looking over the facilities, as he depended heavily on photography for records. On his personally conducted tour he noted the best equipment (which the photographer pointed out with pride), where it was kept and where the keys were, if any. If the booty was worthwhile, he paid two or three calls, making himself a familiar figure in the department and corridors. When his chance came he helped himself lavishly and disappeared.

Precision photographic equipment is not only valuable; under present conditions some of it cannot be replaced. It goes without saying that all ordinary precautions should be taken; valuable equipment should be locked up whenever it is not under surveillance and its whereabouts should not be made known to strangers. But a few extraordinary precautions are worth considering too. The general insurance rate for this type of equipment is 2%. Thus for $2.00 on every $100.00 you can at least recover financially from loss or theft of your camera, or any damage occurring when the camera is used by you or anyone else in any place whatever. If you are connected with an institution it is a good plan to find out what the institution's insurance policies are and whether they really protect your equipment under your working-conditions. Many hospitals and universities are insured only against damage by fire, and against forcible breaking and entering. This type of policy gives no protection against inside jobs, sneak-thieves and loss of equipment being used outside the department. Become familiar with the terms of the protection afforded you, and if they do not cover your working contingencies, by all means take out extra insurance for your valuable items or at least increase your precautions against losing them. And remember that the more difficult it becomes to get good lenses, condensers, etc., the more carefully you should safe-guard your own.

AMERICAN STANDARDS OF PHOTOGRAPHY

"*Proposed American Standard Specifications for Determining Photographic Speeds of Roll Film, Film Packs and Miniature Camera Films.* Not approved. Published for Trial and Criticism. American Standards Association. Sponsor: Optical Society of America." This is the title of an article in the *Journal of the Optical Society of America,* January, 1941 and is the first of a series of proposed American standards in the field of photography. It describes a method of exposing and processing sample film, analyzing the density and thereby finding the speed of the film in terms strictly defined. After a year of trial modifications may be introduced. It will then be offered by the American Standards Association as the national standard method of determining film speed, and the multiple methods that now confuse us, such as the DIN, Scheiner, Eastman, Weston, will be superseded.

The present standard is of interest mainly to the manufacturer. It is the work of one subcommittee and not until other subcommittees on lenses, illuminants, processing, etc. submit similar reports will the whole field be integrated into terms useful to the general photographer. When the project is completed, he will find that many things have been done to simplify his life. The various ways of marking lens stops will have been reduced to one simple system. Tripod screws and sockets will be uniform, as will cable releases. Needless variations in film perforations and film sizes will be eliminated. Most important of all, terminology that is loosely used at present because it deals with variable systems, will take on a precise and therefore greater meaning.

Committee 2-38 of the American Standards Association is sponsored by the Optical Society of America and has the secretariat in this field of the International Standards Association. Scope: the formulation of definitions, dimensional standards and recommended practices in the field of photography and the establishment of methods for testing, rating and classifying the performance characteristics of materials and devices used in photography including its industrial applications, but excluding cinematography. The committee is divided into 9 subcommittees.

The B.P.A. representative on the Committee on Standardization in the Field of Photography is Mr. Louis Schmidt of the Rockefeller Institute for Medical Research, New York City. Mr. Ralph Creer of the Veterans' Facility, Hines, Ill. is alternate representative. Other members on the committee are L. V. Foster, Bausch & Lomb Optical Co., and Oscar W. Richards, Spencer Lens Co. The latter is also chairman of the Subcommittee on Printing and Projection Equipment and Special Instruments.

Report of the Committee on Motion Pictures

A. *Film Depository of the Wistar Institute of Anatomy and Biology, Philadelphia, Pa.*

The Wistar Institute is establishing a Film Depository with the cooperation of the American Film Center, the American Association of Anatomists and the American Society of Zoologists. Films accepted will be available for showing at the Institute and for distribution provided the author so wishes. Films are approved by one or more members of the committee: Elliott R. Clark, Warren H. Lewis and Carl C. Speidel representing the Anatomists; Ralph Buchbaum, Robert Chambers and Oscar W. Richards representing the Zoologists; and Edmond J. Ferris, Cranford Hutchinson and John S. Nicholas representing the Institute.

An approved film may bear the Institute's Seal of Approval and a critical review of the film will be published in the *Anatomical Record.* Films for sale or rental will pay the author a royalty and relieve him of the commercial details. The deposit copies may be viewed for research or selection of teaching material at the Institute by interested parties. In time the Institute will develop a clearing house for information about the better biological films and the Seal of Approval will mark superior films. Films rejected will be returned to the author. For further details write Dr. Edmond J. Ferris, Executive Director, Wistar Institute of Anatomy and Biology, Philadelphia, Pa. Members of the *Biological Photographers Association* are invited to submit their biological films.

B. *Films by Members of the Biological Photographic Association.* 1940.

Armstrong, H. Burnett, *Manometric Measurements in Cadaveric Cavities,* with controls in normal lungs. 16mm. color.

-- *Perineal Prostatectomy,* using a new drape. 16mm. color.

Corrigan, K. E. A short 16mm. film showing (fluoroscopic) swallowing mechanism in a cat.

-- 8mm. Kodachrome of *Petitmal Epilepsy in Dogs.*

Downing, J. G., *Industrial Dermatoses.* A colored film exhibited at the June 1940 A.M.A. Meetings at New York City.

Dunton, S. C., *Blind Cave Fish of the Cueva Chica. Aquarium Highlights*—1940. Both 35mm. sound on film.

Futterman, Max J., *Preventative Orthodontics.* Kodachrome.

* Received for publication February 24, 1941.

Harding, Ferdinand R., *A Medical (Nose and Throat) Comedy.*

Johnson, Geo. Fiske, *Agricultural and Economical Subjects.* Five reels silent color film.

Lown, Wilbour Chace, *Transportation of Fracture.* 600 ft. black and white.

-- *Alveolarplasty.* 200 ft. color.

Palmer, Vincent, *Mites and Monsters.* Minute to gigantic sea creatures, 35mm.

Pijper, Adrianus, *Motility of Typhoid Bacilli.* 400 ft. 16 mm.

-- *O-agglutination of Typhoid Bacilli.* 400 ft. 16mm.

-- *H-agglutination of Typhoid Bacilli.* 700 ft. 16mm.

C. *Motion Pictures in Color. Thoracic Surgical Services, University of California Hospital and San Francisco Hospital by Harold Brunn and Associates.* 1936-1939. *Reported by H. Burnett Armstrong.*

1) Surgical treatment of lung abscess. Discussion of the one and two stage procedures. 2) Muscle plastic for bronchial fistulae. 3) Phrenic nerve crushing for pulmonary tuberculosis. 4) Thoracoplasty with Semb apicolysis for pulmonary tuberculosis. 5) Eloesser flap. Preliminary treatment for tuberculous empyema and chronic empyema (nontuberculous). 6) One-stage lobectomy for bronchiectasis. 7) One-stage lobectomy for pulmonary tuberculosis. Indication—stenosis of the stem bronchus. 8) Pneumonectomy for cancer of the lung. 9) Resection of infected teratoma in anterior mediastinum. 10) Resection of dermoid cyst of the anterior mediastinum. 11) Surgical treatment of echinococcus cyst in the left upper lobe by formalage. 12) Resection of large fibroma of the left lower lobe. 13) Repair of traumatic diaphragmatic hernia, transpleural approach. 14) Repair of hiatus hernia, abdominal approach. 15) Pulsion diverticulum of the esophagus, one-stage procedure. 16) Pectus excavatum. Surgical treatment and discussion of developmental causes. 17) Freund operation for emphysema. 18) Pericardiectomy for constricting pericarditis. 19) Beck's operation—transplantation of pectoral muscle for coronary disease of the heart.

OSCAR W. RICHARDS, *Chairman*
19 Doat St., Buffalo
K. K. BOSSE
JEAN KIEFFER

New Members

We take pleasure in announcing the following new members:

Baez, Manuel Martinez, M.D. (*Louis Schmidt*[15]), Napoles 55, Mexico, D. F.
Bell, Dennistoun M., M.D. (*Louis Schmidt*[16]), Broadview, Amagansett, N. Y.
Brubaker, J. D. (*John A. Maurer*[1] *and Leo C. Massopust*[5]), 805 Greenleaf St., Evanston, Ill.
Burack, H. (*Ralph Creer*[11]) 3002 Lake Park Avenue, Chicago, Ill.
Cartwright, J. (*Leo C. Massopust*[6]), Central Maine General Hospital, Lewiston, Maine.
Cohn, Bernard M., 9051-186th St., Hollis, N. Y.
Conrath, Philip A. (*Walter G. Elle*), 1402 S. Grand Blvd., St. Louis, Mo.
Deitchman, Morris, M.D. (*W. C. Lown*[3]), 404 Central Tower Bldg., Youngstown, Ohio.
Doles, H. McQuire, Driver Bldg., Norfolk, Va.
Evans, Titus C. (*Elbert P. Little*), Dept. of Zoology, State University of Iowa, Iowa City, Iowa.
Falconer, Roy A., M.D., 11120 Huston St., N. Hollywood, Calif.
Fallon, John (*Louis Schmidt*[17]), 390 Main St., Worcester, Mass.
Finkelstone, Carleton E. (*David W. Dick*[1]), 1854 North Avenue, Bridgeport, Conn.
Finkelstone, Edward R. (*David W. Dick*[2]), 1807 Park Avenue, Bridgeport, Conn.
Francis, Howard, Jr., 1047 N. 4th Street, Reading, Pa.
Gaynor, Valeria, Swedish Hospital, Minneapolis, Minn.
Gilson, Dr. W. E., Milwaukee Hospital, Milwaukee, Wis.
Gould, Robert F. (*Stella Zimmer*[1]), Pulp Plant Laboratory, Memphis, Tenn.
Green, Edwin T. (*W. C. Lown*[4]), 15 Ash Street, Cambridge, Mass.
Homan, Jos. B., Medical Art Dept., College of Medicine, University of Cincinnati, Cincinnati, Ohio.
Hurt, Arthur C., Jr., 215 W. 7th Street, Los Angeles, Calif.
Knoepp, Melvin H., M.D., Provost Road, Pittsburgh, Pa.
Lewis, John B., 8026 Frankford Avenue, Philadelphia, Pa.
Martin, Dr. J. M. (*Robert A. Sage*), 3501 Gaston Avenue, Dallas, Texas.
Mitchell, Clarence B. (*Ralph Creer*[12]), 721 N. Michigan Avenue, Chicago, Ill.
Morelli, Mary (*Margaret McDonnell*), 108-30 41st Ave., Corona, L. I., N. Y.
Murray, Harold H., D.M.D. (*Leonard Julin*[1]), 710 General Insurance Bldg., Seattle, Wash.
Seeds, Dr. Asa E. (*Robert A. Sage*[2]), Dept. of Radiology, Baylor University, Dallas, Texas.
Smith, R. Earle, 705 Ashton Bldg., Grand Rapids, Mich.
Speirs, Robert S. (*Leo C. Massopust*[7]), 1015 Clymer St., Madison, Wis.
Van Wart, Robert, Grass Lands Hospital, Valhalla, N. Y.
Voyles, Dr. John S. 3720 Washington Blvd., St. Louis, Mo.
Wald, Donald J. (*Ralph Creer*[13]), 5105 University Avenue, Chicago, Ill.
Weiss, Samuel, M.D. (*Saxie Greenfield*), 146 Central Park W., New York., N.Y.
Williams, Robert L. (*Leo C. Massopust*[8]), 2709 N. Farwell Avenue, Milwaukee, Wis.
Young, Irvin Carson, 1610 West Lake St., Minneapolis, Minn.

B. P. A. Officers and Committee Chairmen

President	Leonard Julin Section of Photography Mayo Clinic Rochester, Minn.
Vice-President	Ferdinand R. Harding The Children's Hospital Boston, Mass.
Secretary	Anne Shiras University Office Magee Hospital Pittsburgh, Pa.
Treasurer	Stella Zimmer Photographic Dept. School of Medicine Syracuse University Syracuse, N. Y.

Motion Picture Committee	Dr. Oscar Richards Spencer Lens Co. Buffalo, N. Y.
Committee for Cooperation with the Army	Ralph P. Creer Veterans' Facility Hines, Ill.
Committee for Cooperation with the Navy	Ferdinand R. Harding The Children's Hospital Boston, Mass.
Albums	Florence Melvin Coe Dept. of Medical and Surgical Research Ohio State University Columbus, Ohio
Traveling Salons	Louis Schmidt Rockefeller Institute for Medical Research New York, N. Y.
1941 Convention Chairman	To be announced later.
1941 Salon	Nathan S. Horton 504 Shaughnessy Building Montreal, Canada

Please make all checks payable to the
BIOLOGICAL PHOTOGRAPHIC ASSOCIATION

Sustaining Members

1940-1941

Louis P. Flory
Boyce Thompson Institute for Plant Research
1086 Broadway
New York, N. Y.

Arthur W. Proetz, M.D.
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St. Louis, Mo.

George H. Semken, M.D.
16 West 85th Street
New York, N. Y.

Anne Shiras
University Office
Magee Hospital
Pittsburgh, Pa.

Lloyd V. Varden
Agfa Ansco Company
Binghamton, N. Y.

Leonard Perskie
Defender Photo Supply Co.
275 Seventh Avenue
New York, N. Y.

Editor's Note: The editor is keenly interested in discussion of new technics and in receiving copies of unusual photographs. Any suggestions as to sources of this material will be gratefully received.

For **A LIFETIME OF WATER FREE FROM SUSPENDED MATTER . . . . .**

THE MIROTEX WATER FILTER

★ SAFE ★ SUBSTANTIAL ★ SELF CLEANING ★

NO REPLACEMENTS NECESSARY Professional Photographers know that for finer prints, the use of water free from suspended matter is highly desirable.
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KODAK EKTRA

(prices start at $235)

UNEQUALLED in the quality and scope of its lenses . . . the performance of its shutter . . . the adaptability contributed by its backs . . . the efficiency of its range finder . . . the convenience and precision of its view finder, *Kodak Ektra* can produce finer results, throughout a wider range, than any other existing camera.

Specifically, *Kodak Ektra* offers these features of particular interest to the scientific photographer: (*1*) Six Kodak Ektar lenses of focal lengths from 35 mm. to 153 mm. (*2*) Focal-plane shutter with speeds from 1 to 1/1000 second. (*3*) Built-in variable-power view finder with automatic parallax correction. (*4*) Coupled split-field range finder. (*5*) Ground-glass focusing back. (*6*) Optical view finder and range finder for extreme close-up work. (*7*) Interchangeable 35 mm. film magazine backs. (*8*) Special flash synchronizer.

A 40-page booklet, free at Kodak dealer's, pictures and describes the Kodak Ektra in full detail.

EASTMAN KODAK COMPANY, Rochester, N. Y.

Forestry

The Journal of the Biological Photographic Association

JUN 9 1941

JUNE

VOLUME 9 1941 NUMBER 4

LEO C. MASSOPUST,
EDITOR

For the advancement of photography in relation to the biological sciences.

Published Quarterly For The Biological Photographic Association
At 558 Elizabeth Street
Waukesha, Wisconsin

OFFICIAL PUBLICATION OF THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION

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PUBLISHED QUARTERLY FOR THE BIOLOGICAL PHOTOGRAPHIC ASSOCIATION INC. AT ELIZABETH BUILDING, WAUKESHA, WIS.

Entered as second class matter at the Post Office at Waukesha, Wis., under the act of March 3, 1879.

Subscription price $3.00 per volume. Single copies 75 cents.

The Journal of the Biological *Photographic* Association

Official Publication of the Biological Photographic Association

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VOLUME IX NUMBER 4

JUNE » 1941

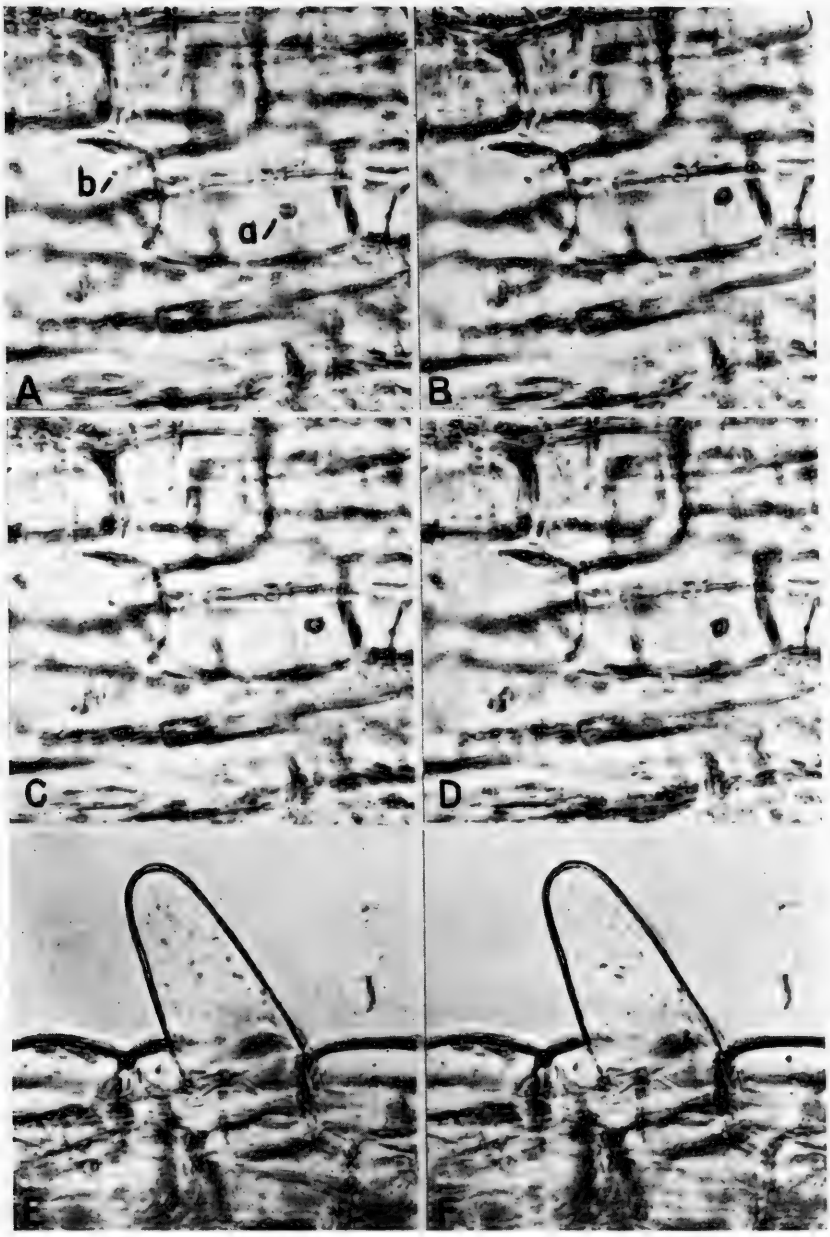


Figure 1. Non-stereoscopic pairs of photomicrographs—x790. Time interval—one minute. A, B, C, and D—longitudinal section—mid rib of a peach tree leaf infected with Peach Yellows. E and F—root hair of a root tip from a diseased peach tree infected with Peach Yellows.

Stereoscopic Methods for Detection and Study of Intracellular Motion

by Louis Paul Flory*

IN the study of living cells, the biologist is often concerned with intracellular motion—motion of the material within the cell. The visual use of the microscope produces only a transitory image of this motion. Even during a short period of time, and at the highest magnification, the amount of material included in the field of view of the microscope presents so complex a pattern that the eye cannot follow, and the mind cannot remember, all that has taken place within the cell.

Visual inspection is frequently supplemented by photomicrography. This furnishes a permanent record that can be studied at leisure, but represents only one particular phase of the intracellular motion. If a series of photomicrographs are made with a short interval of time between exposures, the motion of any cell body may be traced by direct visual inspection. This is a tedious process.

Cinephotomicrography is a further supplement, and will show the intracellular motion in great detail. The film can be projected repeatedly for further study. This method, however, suffers from the same disadvantage as visual inspection, in that it is difficult to comprehend all that is taking place.

Hartzell[1] made use of cinephotomicrography of intracellular bodies. Motion pictures were taken and projected at normal speed for a comprehensive study of the motion; but by projecting consecutive frames, as still pictures, on cross section paper, it was possible to trace the degree and direction of movement of a specific body. This procedure, while accurate, entailed considerable work. The author, who made the motion pictures for Dr. Hartzell, attempted to find a more expeditious method.

Stereoscopy seemed to be a possibility. It should be pointed out, however, that stereoscopic methods for the detection of motion are not based upon the comparison of a stereoscopic pair of negatives or prints, but upon the comparison of a non-stereoscopic pair where the difference between the pair is, strictly speaking, one of time, not space.

* Received for publication April 18, 1941 from the Boyce Institute for Plant Research, Yonkers, New York.

[1] Hartzell, Albert. Movement of Intracellular Bodies Associated with Peach Yellow; Contributions from Boyce Thompson Institute; Vol. 8, (Jan.-March, 1937), No. 5, pp. 375-388.

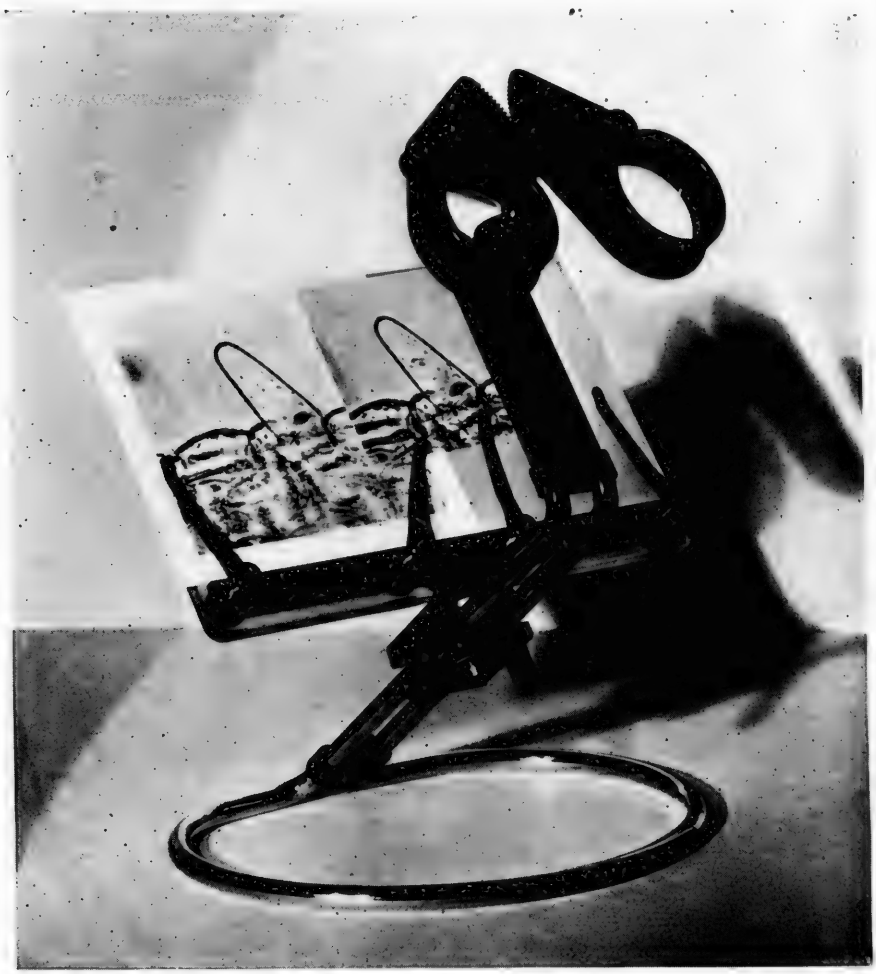


Figure 2. Zeiss stereoscope showing a non-stereoscopic pair of unmounted prints (E and F, figure 1) on stage.

About the year 1901, the introduction of the stereocomparator made it possible for astronomers to compare two stellar photographs taken from the same place and of the same star field, but separated by an interval of time. When the star images on the two stellar photographs were brought into coincidence in the stereocomparator, the majority of the star images appeared to be in one plane. Any star which was recorded in one photograph but not in the other, or any star which had shifted position during the interval of time between exposures,

appeared to stand out from the general star field. This subjective impression is due to parallactic displacement and, while the two stellar photographs are not a stereoscopic pair in the usual sense of the term, the principles governing stereoscopic viewing are applicable. While these principles are based upon a displacement in space, they can be applied to a displacement due to motion during an interval of time.

In spatial stereoscopy, if one point in a stereoscopic pair of photographs is displaced with reference to a fixed point in the same photograph, and toward the corresponding point in the other photograph, the displaced point will appear in the stereoscope to stand out in front of the fixed point. If displaced away from the corresponding point in the other photograph, it will appear to have receded behind the fixed point. It is necessary that the displacement be small enough to permit convergence of the optical axes of the eyes when using the stereoscope in order that the subjective impression may be achieved. If the distance between the displaced points is too great, the appearance in the stereoscope is that of two separate points, both situated stereoscopically in front of the fixed-point plane.

The blink microscope was a further development applying stereoscopic methods to astronomy. A special instrument similar to the blink microscope was developed for the inspection of currency, coins, and postage stamps which may show differences in configuration due to forgery. The stereocomparator, the blink microscope, and other similar instruments are very expensive and usually inaccessible to the biologist.

Hardy and Perrin[2] describe a method of comparing a non-stereoscopic pair of photographs using anaglyphic filters, one over each of the oculars of the stereoscope. This method has been used to detect small changes in configuration, but suffers from the general fault of anaglyphic systems—that of rapid eye fatigue. Photomicrographs of living biological material usually have a long scale of tones, and it is difficult to separate these tones when using the filters. For this reason, also, the anaglyphic method is not satisfactory.

The methods outlined above led the author to believe that a simpler stereoscopic method could be used. It was thought that the solution to the problem might be simplified by comparing the negatives in the stereoscope. This was found less satisfactory than comparing prints, as when the field of view recorded on the negatives was greater than the field of view of the stereoscope, the two negatives could not be combined

[2] Hardy, Arthur C. and Fred H. Perrin. The Principles of Optics; McGraw-Hill Book Company, New York; 1st Edition, 1932, p. 532.

stereoscopically without cutting them. This limitation does not apply to prints made on paper.

It was also thought that the method of producing luster by combining black and white in the stereoscope, attributed to Professor Dove, and illustrated in Judge's[3] book on stereoscopy, might be found useful. In this procedure a negative and a print are compared, or a print and a reversed print. Where the two fields are identical the appearance is one of a lustrous image, but where a body is recorded in only one print, it appears vividly black or white depending upon whether it is recorded in the print or in the reversed print or negative. While presenting a very striking appearance in the stereoscope, the quality of the image of the negative or the reversed print cannot compare with that of the print, and this method was abandoned in favor of the stereoscopic comparison of two straight prints.

The method found most useful for the detection and study of intracellular motion is based upon the principle of parallactic displacement described above, and consists of viewing two photomicrographs taken with a short interval of time between exposures. The interval of time will depend upon the rapidity of the intracellular motion. The two prints which are used are in no sense a stereoscopic pair, but are two photomicrographs of the same field taken at different times. A, B, C, and D, figure 1, are four photomicrographs of a longitudinal section of the mid rib of a peach tree leaf infected with Peach Yellows. The interval of time between exposures was one minute; the magnification is x790. Unaided visual inspection shows that the movement of a body such as indicated at (a) can be easily traced. It is evident that such a body as (b) has moved between exposures, and in D, figure 1, has disappeared from the field. If unmounted prints of A and B, figure 1, are placed on the stage of the stereoscope shown in figure 2, they will combine stereoscopically, and the general field, consisting of the cell walls and associated material, will appear to be in one plane. Body (a), however, will appear as two separate bodies somewhat nearer the observer than the general field, as the distance moved by body (a) between exposures was too great for the images to be combined stereoscopically. Body (b) has moved only slightly, and therefore will combine, and the subjective impression is that of a body closer to the observer than the general field. The difference between the subjective impressions of the two images of body (a) which do not combine, and the combined image of body (b) must be experienced to be appreciated. There is a distinct difference in

[3] Judge, Arthur W., Stereoscopic Photography; Chapman and Hall, London, 1935; Second Edition, p. 200.

the images, and this may be brought out clearly by blinking one eyelid. This will show the shift of the two images of body (a) very distinctly.

A comparison between separate prints of B and C, figure 1, may then be carried out, and both bodies (a) and (b) will appear as two separate images each; while if C and D, figure 1, are compared, body (a) will combine stereoscopically and body (b), which is recorded only in C, and not in D, will also stand out from the general field. Blinking one eyelid will not only indicate the change of position of a body which will not combine, but it will also indicate in which photograph the image of the body was recorded. This blinking approaches in principle the blink microscope.

E and F, figure 1, are two photomicrographs of a root hair of a root tip from a diseased peach tree infected with Peach Yellows. The magnification is x790. Here the configuration is more complex. Unaided visual inspection shows very little of the movement that has taken place between exposures, the interval of time being one minute. Inspection of separate prints in the stereoscope, however, will show that at least seventeen movements have taken place, and by blinking one eyelid this will become very apparent.

This method may be used to study enlargements of individual frames from a motion picture film of intracellular motion, provided that the magnification is great enough to show the required detail when the frames are enlarged to a size which can be accommodated on the stage of the stereoscope. The frames compared may be consecutive, or at a greater time separation, depending upon the amount of movement which has taken place between consecutive exposures. It must be remembered, however, that the longer the interval between exposures, the more phases of the motion are lost. Any interpretation of the motion must be qualified because of the phases not recorded.

Where the problem is only one of detecting motion it would be necessary to make only two photomicrographs separated by a suitable interval of time.

In practice it is not necessary to cut the first print, if the field of view recorded is larger than that accommodated by the stereoscope. The first print is placed upon the stage of the stereoscope and centered under one of the oculars, then held in place by the clips on the stage, as shown in figure 2. The second print is placed under the other ocular and shifted while observing the images of the two prints with both eyes. A position will be found where the general field of the two prints will combine and appear to be in one plane. When this position is found, the second print can be clipped to the stage. If the field of view included in the prints is

larger than the stereoscope can accommodate, only one print need be trimmed.

Any body appearing in only one of the prints, or any body that has shifted position between exposures, will appear to stand out from the general field. After the degree of motion has been detected, it is a simple matter to determine the direction. Further study is simplified by blinking one eyelid.

The stereoscope shown in figure 2 is well adapted to the study of photomicrographs. The interocular distance may be adjusted to fit the observer. The oculars are of short focal length, well corrected, and produce a secondary magnification which is sufficient for the close inspection of the details in photomicrographs. Any stereoscope may be used, but the features mentioned above are of great help in securing adequate stereoscopic vision.

The author has found the stereoscopic method for the detection and study of intracellular motion most useful. The procedure is not complicated, but there are individuals with an undeveloped binocular sense, and for them the method would result in failure. It is, however, a distinct help to those who can achieve stereoscopic vision. The biologist studying living material will find it of more than theoretical interest.

DEVELOPMENT OF A SALAMANDER*

L. S. STONE AND T. C. KRAMER

(400 feet, monochrome, silent) Distributor: Films, Inc., New York

This film, taken from life with the aid of the time-lapse apparatus, presents an almost continuous picture of the embryological development of a salamander, from the single-cell stage to the time of the first meal. It shows brilliantly the early cell divisions, the formation of the blastopore, and the formation and closure of the neural groove. Less spectacular, but satisfactory, is the later growth story. The main feature is preceded by standard speed scenes showing the habitat of the salamander and the egg cluster; and it is followed by others depicting blood circulation in the tail, "the first meal," and locomotion in a 3 year old specimen. The photography and titling are excellent.

This picture should form a valuable adjunct in the teaching of embryology. E. R. CLARK.

* Reprinted with permission from the Anatomical Record. Reviews of Approved Films in Anatomy and Biology. Vol. 79, No. 3, March, 1941.

Diatoms and Photography

by Paul S. Conger*

IN response to Massopust's article, "Is the Diatom Coming Back?",[1] it may seem of interest, briefly, to call attention to some of the historical development and the close relationship of diatoms to biological photomicrography.

The fine designs to which Massopust fell heir, and which inspired his article, represent the highest attainment of the artful micro-technique developed by the early microscopists for handling these delicate forms.

Some more of these designs, now in possession of the Smithsonian Institution, are shown here. Figure 1 is of a slide by J. Thum, a contemporary of J. D. Möller, mention in Massopust's article. These men, Möller and Thum, established so-called "Institutes für Mikroskopie," where there must have been numbers of skillful and busy persons employed in the quantity production of these magnificently fancy slides, and of many others as well. They catered to the wants of microscopists, members of microscopical societies which flourished in many of our larger cities in the "nineties" when the microscope reached a peak of popularity as a means of recreation, and such enthusiastic men got together regularly to exchange notes and to revel over their fine slides. One may well imagine their exhilaration at viewing some of these fine specimens in all their delicacy and colorful irridescence, for which even the best photograph is but a poor substitute.

The methods of Möller and Thum were carefully guarded secrets, and even though we are able today to make equally fine preparations, we are left to conjecture as to how they worked and whether some of their methods may have had advantages over ours. Certainly at least the cumbersome technique of arranging diatoms free-hand by use of a split sable hair or pig's eye-lash mounted in a handle, must have long since given way to more precision, and diatom technique had come into the machine age, with the development of various simple micro-manipulative devices or so-called "mechanical fingers" for handling them.

An old Spanish physics professor, Don Ernesto Caballero y Bellido, went still further in his perfectly controlled method, whereby all operations are carried out under an hermetically sealed bell-jar on the microscope stage, thus entirely excluding possibility of interference by air

* Research Associate, Carnegie Institution of Washington, Custodian of Diatoms, United States National Museum. Received for publication May 5, 1941.

[1] Massopust, L. Is the Diatom Coming Back? J. Biol. Photo. Assn. 9:115-118. March 1941.

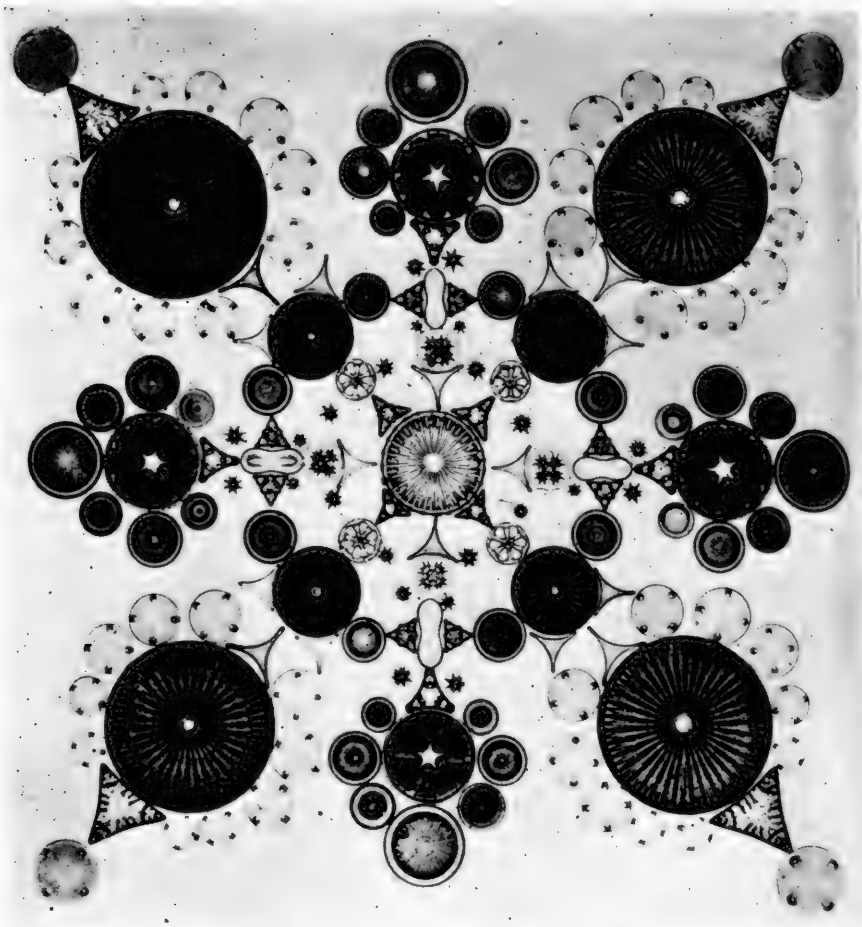


Figure 1. Design by J. Thum. X 75.

movement, change in humidity, or dust contamination. The finish obtainable by this method is shown in one of Don Ernesto's own masterful preparations, figure 3.

These elaborately fancy slides, purely showy, and suggestive of a lavish expenditure of time and patience in their preparation, notwithstanding the scorn frequently accorded them by practical-minded scientists as impertinent to the needs of science, did two important things for diatom study and microscopy. First, through their popular appeal, they fostered the interest in diatom study, which, because of its critical requirements for the best possible proficiency in performance of the microscope,

created an insistent demand for the improvement of microscope lenses. This resulted in those beautifully corrected lenses which make possible the satisfying results of modern photomicrography. Second, they stimulated the perfection of the artful micro-technique of diatom preparation, without which much important research on diatoms, and the best effects in their photomicrography would not have been possible. These slides are simply the aesthetic diversion of an otherwise highly practical method.

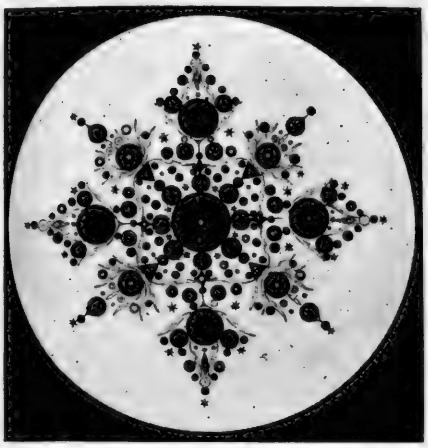


Figure 2. Fine Design. X 40.

Strangely enough, despite the long history of association of diatom study with photomicrography, by far the greater amount of illustration of diatoms, so essential to the study of an organism of this kind, has been by means of drawing. Such illustration has been, in general, excellent, in the case of some artists supremely fine, and with many diatoms it is superior as a method to photography. But there are a vast number of the diatoms to which photography rightly applied can greatly ease and facilitate illustration, as well as give a shading and softness of tone seldom fulfilled in drawing.

As early as the 1850's, the advantages of photography for picturing microscopic objects were advocated, but due to the inferior equipment the early results were disappointing. This disappointment greatly retarded the wider adoption of the method for diatom illustration. Even following the attainment of the high perfection of modern lenses, diatom photomicrography has been slow to recover from its earlier failures and to overcome further deficiencies due to lack of appreciation of other factors involved in their successful portrayal.

Having finally achieved in the modern photomicrographic system a highly perfected optical allignment, we cannot recline in a state of contented relaxation, as seems a common tendency, and regard photomicrography as a sort of "fixed focus" affair. The successful photography of diatoms is more than a routine procedure; it is an art and a science. Inserting a diatom slide in the plane of focus of a good photomicrographic system (however perfect), gauging the time, and snapping the shutter,

may result in a reasonably good picture; but there is a big gap between taking a routine photomicrograph and correctly portraying a delicate diatom in the fine sharpness and tone of its natural appearance. The photomicrographer needs to count among his repertoire of skills contributing to the making of really fine photomicrographs, a wide range of technical ability, reaching all the way from a well graduated series of expletives suited for all contingencies, to a certain deftness in the art of supplicative prayer.

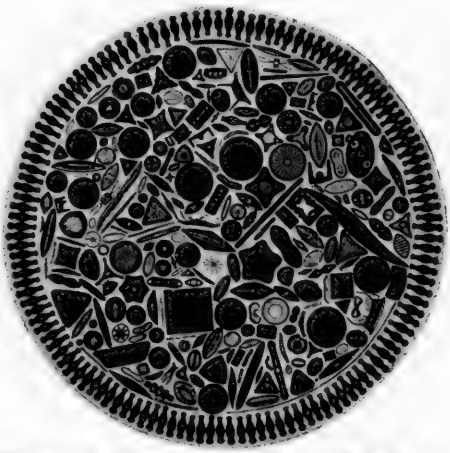


Figure 3. Diatom Group by Caballero. X 60.

It is not the purpose of this short article to describe procedure for dealing with the many problems which pertain to photographing diatoms, but rather to call attention in general to points which need consideration, or the importance of which is often under-estimated. As "a chain is no stronger than its weakest link," so no link in this process, from the preparation of the diatom to the printing of the finished plate, can be neglected in its minutest detail, if we are to obtain a true and fine representation of the original subject.

As a subject for biological photography, diatoms are most exacting, for several reasons. In the first place, there are more than 10,000 kinds, ranging in size from a few thousandths of a millimeter to nearly 2 millimeters in diameter, and in heaviness of structure from frail, almost invisible, phantoms, to others that are practically opaque. Secondly, in contrast to many fields to which photomicrography is applied, here one deals with an unstained glassy object of but slightly different absorptive or refractive properties from that of the medium in which it is immersed; an object which is not flat like a microtome section but has more or less, often considerable, depth and curvature. These problematic features are augmented by troublesome contours and halation surfaces, fairly inconspicuous visually, but which stand out like fuzzy black margins to an otherwise well blended picture. It is the problem of the photographer, on the basis of his judgment and experience, through the selection of proper media, and correct lighting, to bring out or inhibit the details of this structure as the case may require; and so, due to the features above

mentioned, the diatom proves a most subtle subject, under the ordinarily difficult conditions of photomicrography.

The time of exposure, and selection of proper plates and papers to bring out the best effects in the picture are routine photographic matters which merely deserve mention here.

Assuming that all the foregoing factors have received most scrupulous attention, the ingenious and skillful photographic finisher can yet do much to correct faults and blemishes in the picture and give to it the tone of natural appearance.

Beyond all this, the fate of our illustration lies yet in the hands of the plate printer, who, not knowing the nature of the subject, can make or ruin the picture, depending upon the method and the heaviness or coarseness with which he renders it. It is not so much the relative difficulty of these various steps, but lack of appreciative attention to some one of them, which is liable to spoil an otherwise potentially good picture.

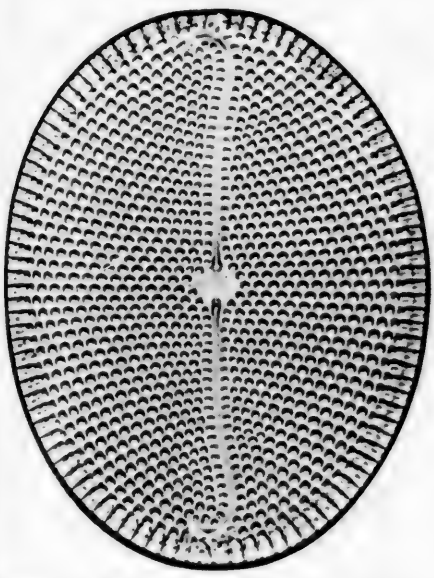


Figure 4. Mastogloia stlendida (Greg.), By Adee. X 745.

A handsome diatom known as *Mastogloia splendida,* figure 4, illustrates both the high ideal of accomplishment, and the qualifications of a person well equipped. Note the delicate shading of the "beads" obtained by slightly accentuating the illumination on one side. It is the work of Hon. Alvey A. Adee, formerly Assistant Secretary of State, in charge of routine form and style in the State Department. Mr. Adee exemplifies the type of man in whom are embodied in one personality all the attributes essential to realization of the best results. He was at once, a most careful craftsman, with a fair knowledge of diatoms, a skillful micro-technician, an able microscopist, an expert photographer, and a man of artistic temperament. The advantages of such a combination can be readily appreciated in so critical a method, in which diatoms still retain the position as the best objects for testing the

quality of high power lenses and precision in the adjustment of the microscope.

In later years Philip Gravelle, of South Orange, N. J., another clever and painstaking artist, has done enviable work. In 1924 he was the first person outside of England and the only American to receive the much prized Barnard Medal of the London Photomicrographic Society. The diversity of his interest has covered the whole range of photomicrographic application and led to much experimental work resulting in design of new apparatus and methods. Figure 5, is a sample of his skill and beautifully illustrates double exposure in different focal planes to show depth.

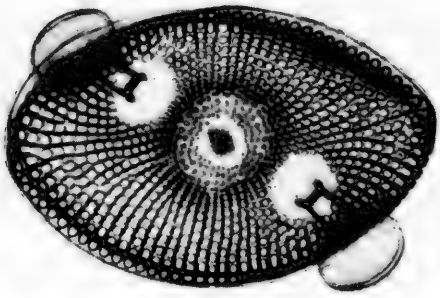


Figure 5. Kittonia elaborata. Photo by Gravelle. Double exposure in different focal planes to show its depth. X 310.

Since the early days, diatom science, which has made great advances as regards its biological and economic aspects, has likewise been "coming back" as suggested by Massopust in relation to photography. In fact, it is strictly up to date, as illustrated by figure 6, a photograph made through the "electron microscope" of a fragment of *Synedra delicatissima,* magnified 20,100 diameters, and showing the arrangement of its pores. By permission of Dr. D. H. Hamly and J. H. L. Watson; electron microscope, University of Toronto.

With the various advances herein described in the perfection and manipulation of the microscope, it seems now to be within the scope of photomicrography to meet any requirements in depicting the fine structure of diatoms except those of perspective exceeding the range of focal depth at high magnifications.

To the professional student of diatoms, so dependent on the best possible likeness, in his study of the many closely similar species of these minute organisms, photography rightly used now offers a more promising future. We have come out of the age where failure was due to faulty equipment, and into an age of wide availability of fine instruments where the responsibility for "muddy" photographs (poor pictures), can be laid to careless or faulty technique in handling good equipment, and adjusting it to the particular problem at hand.

To the biological photographer, whose aim is the pleasure derived from skillful application of photography to difficult and special purposes, the photomicrography of diatoms can challenge his ingenuity and faculties to the utmost, in offering a most critical procedure applied to a most exacting subject, the results of which, both tangible and intangible, may richly reward his efforts.

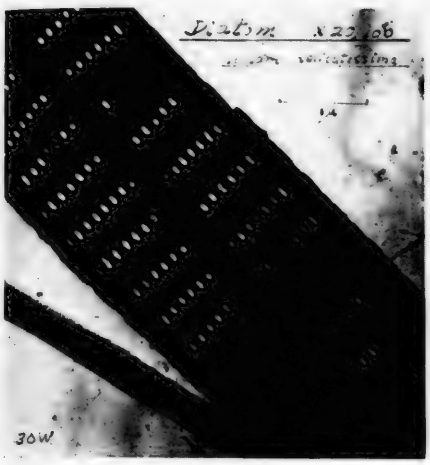


Figure 6. Synedra delicatissima W. Sm. By Watson. X 20,100. (Electron microscope.)

The old microscopists tested not only their lenses but also their skill in resolving the most delicate diatoms, and, so doing, advanced the subject of microscopy. So the photomicrographer may improve his skill by applying himself to more and more difficult problems, for which the photography of diatoms is a good test. The history of science is the progressive solution of difficult problems, and diatoms still remain on the frontiers of microscopy and photomicrography. The problems surrounding them have not diminished, and the methods of examining them have greatly improved, conspiring to make their photography both more satisfactory and more useful than in the earlier heyday of their interest.

COELENTERATA: OBELIA, THE SEA ANEMONE, METRIDIUM*

EARLE B. PERKINS

(375 feet, kodachrome, silent)

The first part shows living Obelia in habit and magnified views of the hydranths. The rest of the film shows behavior and feeding of Metridium and the reactions of small fish as they approach the anemonie. The slow movements are typical of the nerve net control and the film will be useful in courses in animal behavior and general physiology. Parts of the film would be appropriate to an elementary college course. The color is good. OSCAR W. RICHARDS.

* Reprinted in part with permission from the Anatomical Record. Reviews of Approved Films in Anatomy and Biology. Vol. 79, No. 3, March, 1941.

Organization and Conduct of Biological Photographic Departments

by Robert A. Sage*

MANY photographic departments in medical schools and research institutions have had modest beginnings and have subsequently enjoyed rapid growth. Not many years ago, clinical laboratories were rather small organizations. Their problems of growth and division of labor among technicians are somewhat analagous to those experienced by photographic departments at the present time. During the past decade, photography has become almost indispensable to scientific endeavor. Cook[1] has recently emphasized the need for departments of scientific photography capable of producing high-grade graphic material for publication. The purpose of this article is to discuss some of the problems peculiar to departments of biological photography.

Studio and dark room design, special apparatus, and equipment for photographic laboratories have lately received considerable attention in the literature. The technics dealing with biological photography also have been treated in detail. Harding[2] was probably the first to call attention to some problems of the relationship of the photographer with staff members and the administration.

Martinsen[3] has recently summarized some statistics which indicate that space in photographic departments has not increased as rapidly as the volume of work, and that the personnel is possibly below the minimum for efficient production. In more than 100 departments reporting, Martinsen finds that the average number of employees per department is 1.4. This is due to the fact that nearly 60 per cent of the entire group operate on part time schedule. In full time departments the average is 2.3 workers. The writer believes that these figures could stand an increase to 1.5 for the part time group, and to 2.5 for the full time group with considerable increase in efficiency to the institutions they serve, and

* Received for publication February 25, 1941 from Baylor University College of Medicine, Dept. of Medical Art, Dallas, Texas.

[1] Cook, Robert, "Chats With the Editor" J. Biol. Photo. Assn. 8:135-140, March, 1940.

[2] Harding, F. R. Importance of the Human Relation Between the Biological Photographer and his Chief, Clients and Patients. J. Biol. Photo. Assn. Vol. 3, No. 2, December 1934. p. 72.

[3] Martinsen, W. L. M., The Onward March of Biological Photography, J. Biol. Photo. Assn. 9:100-101, Dec. 1940.

without too great financial burden. Reasons for advocating this increase will be discussed later. In order to appreciate reasons for the existence of photographic departments, some factors leading to their inception should be considered.

Sooner or later in the course of operating a medical school or research institution, photographs for record or publication, or both, must be obtained. At first the work is often taken to a local commercial photographer, or a part time photographer is called in. This policy usually proves unsatisfactory, since the interest and training of commercial photographers seldom includes scientific work. Consequently, some member of the staff, who has made photography a hobby, attempts to fill the need for illustrations. The department involved orders a camera, lights, developing and printing equipment, and the venture starts off with great enthusiasm. Pictures with sufficient clarity and detail are often a bit slow in coming forth, particularly if the staff member happens to be fond of miniature cameras. At this time, another department in the institution learns about the magic of photography, and more requisitions go in for photographic equipment. Finally, a centralized photographic department emerges out of the disorder.

Many physicians have done and are doing their own photographic work, although few of them still do their own blood counts and blood chemistry. Creer[4] has pointed out the problems involved, and has advocated more intensive training for physicians who intend to do their own work. Harding[5] has outlined the essentials for office equipment for clinical photography. A few physicians have the time and patience to acquire the skill necessary to produce pictures fit for publication; many others apparently cannot spare the time for this, and have part of their work done by persons who cannot appreciate the result desired. Training in photography for reproduction offers photographic departments an additional service, as Creer has suggested, and this phase of activity deserves more attention.

In comparison with other departments serving an institution, a photographic department need not be a luxury. In most medical schools, a well-equipped machine shop is now considered a necessity, since apparatus developed as a part of research problems is not often available commercially. The entire cost of a project destined for publication is likely to be considerable. The salaries of skilled technicians, costly materials, and much time are required. High-grade illustrations are essential

[4] Creer, Ralph, President's Address, 1934 Annual Convention, J. Biol. Photo. Assn. Vol. 3, No. 2, Dec. 1934, p. 31.

[5] Harding, F. R., Application of Clinical Photography to Private Practise. J. Biol. Photo. Assn. 8:132-134, March 1940.

to complete the work, and reflect favorably on the organization sponsoring it.

Before a department of photography is outlined, an effort should be made to determine the various types of photographic work desired, the approximate volume of each type from the various departments, and the probable extent of future work. Department heads should be consulted, and the results of the survey discussed with the administration. It is not always possible to predict exactly the equipment needed, but a thorough acquaintance with the nature of work carried on is valuable in keeping the initial expense as low as possible. The department should have its own budget, and part of this should be set aside for repair and replacement of equipment.

A definite understanding should be worked out regarding the relation of other departments to the photographic division. Staff members trained in some of the larger centers, where the photographic department has been long established, accept as a matter of course the necessity of allowing sufficient time for the production of quality work. On the other hand, some photographers find themselves at the mercy of an occasional individual who insists that his particular assignment be completed at once, without regard to orders already on file. This means overtime work in some instances, and if allowed to continue, results in the formation of a bad policy for the photographic department. As Harding has pointed out, it is the chronic "rush-man" who causes the most trouble. Better system, short-cuts, and occasionally more rapid processing facilities may be in order. Administrative backing is essential if any training program becomes necessary in order to solicit the cooperation of the staff. Considerable tact and patience are equally essential on the part of the photographer.

The staff of the photographic department usually consists of a chief photographer, who has charge of the administrative duties as well as the more complicated procedures, an assistant who handles the routine work and processing, including the clerical work, and a part time assistant who takes care of the simpler phases of the work—often, the non-photographic duties. The more technical procedures include photomicrographs, motion pictures, color photography, infra-red photography, supervision of projection facilities, design and construction of exhibits and any phase of photography demanding special treatment. Copy work, gross specimens, X-ray intermediates, clinical photography, lantern slides, general photographic processing, filing and indexing of negative prints, typing material for slides, titles and charts, projection of films and slides at meetings, and other varieties of routine are the duties of the assistant. In order for

a department to progress, the average of 2.3 workers in full time departments should be increased to 2.5. This applies to departments where the volume of work is large and continuous.

A halftime secretary may care for the non-photographic duties: filing and cross-indexing of material, making appointments, binding the ever-present lantern slides, keeping a busy telephone within bounds, checking in and out material from the library of films and slides, typing material for conversion into titles, slides and charts, a small, but necessary amount of correspondence, and department records. This allows the photographer to devote his time and effort where he is most effective, and enables him to develop the new technics which new problems demand.

Some rotation of duties is desirable when the volume of routine is large enough to cause monotony, and more particularly to insure against delay in production due to illness or absence of one member. The head of the department usually works as hard as his assistants, and no one should enter this field unless he is prepared to accept more or less overtime work at certain periods.

The selection of new equipment should be preceded by a careful study of the types of work proposed, and by a detailed mental rehearsal of the steps involved in production. This is important because of the wide variety of work done, and the fact that extremely few departments can afford luxury equipment. Copying stands are often the most used pieces of equipment, and are usually designed to meet individual needs. The stand described by Payne[6] has advantages in compactness and efficiency. Vertical models may be built to further conserve space. All stands should be equipped for copying by both reflected and transmitted light; the need for this double-duty feature becomes more apparent during rush seasons. Excellent specimen stands have been described by Schmidt and Haulenbeek[7], by Waters[8] and others.

Many workers take pride in building their own copying stands and other apparatus. If time permits, and the facilities of a well-equipped machine shop are available, the apparatus may be built at a considerable saving. Good materials should be used; apparatus constructed from soft wood, and in haste, is likely to need repairs and adjustments at times when speed is called for. Makeshifts are sometimes necessary for unusual photographic problems. For regular production, efficient apparatus is

[6] Payne, W. S., A Combination Copier and Transparency Maker. J. Biol. Photo. Assn. Vol. 1, No. 3, March 1933, p. 159.

[7] Schmidt, Louis, and Haulenbeek, Joseph B. A Method of Photographing Gross Specimens. J. Biol. Photo. Assn. Vol. 1, No. 2, Dec. 1932, p. 76.

[8] Waters, Lewis, Application of Photography to Gross Pathology. Photo. Technique, Aug. 1939, p. 22.

necessary for high-quality results. The services of a competent carpenter and a machinist are likely to save both time and money, and apparatus worth building is far better made from seasoned gum wood or birch, or, still better, of metal.

Designs for complete departments have been treated in detail by Harding[9], Zimmer[10] and by Carlile[11]. Modern dark room design may be obtained from articles by St. Clair and Powell[12] and by the Eastman Kodak Company[13]. "Straight-line" processing is desirable; as few steps as possible between each of the treatments in developing and printing. In the printing room, it may be of advantage to have the main sink located in the center of the room, with printing machines and enlarging apparatus located around the sides. The writer has seen a room of this type in a news photographic department where at least four workers carry on operations without stepping on each other.

Space in some of the newer departments has been somewhat less than the average of the group studied by Martinsen. Since the volume of work has increased 135 per cent in more than 80 per cent of the departments, it is likely that more space will be needed in the future in practically all departments. In planning the general work room where slides, transparencies and prints are finished, it is desirable to have all materials within about three-step reach. Time lost in a single operation is negligible, but the total for a year is appalling. The trend toward more rapid production and the occasional rush order make necessary the elimination of "bottlenecks" and provision for as much system as possible.

The relationship of the photographic department to members of other departments is often the most difficult part of the daily work. The article by Harding[2] on this subject is a classic. Misunderstandings often arise from failure to plan an assignment thoroughly. Staff members are prone to order in a hurry, without sufficient discussion of the result desired and without full appreciation of what is possible from a photographic standpoint. This is particularly true of medical exhibits, and many of the patch-work displays seen at medical conventions are the result of a last-minute, throwing-together process. No theatrical producer would think of bringing his cast to an opening night without adequate rehearsal.

[9] Harding, F. R., The Organization and Equipment of a Photographic Department. Radiography and Clinical Photography, Vol. 14, No. 2, April 1938, p. 2.

[10] Zimmer, Stella, A Modern Photographic Division. J. Biol. Photo. Assn. Vol. 7, No. 4, June 1939, p. 153.

[11] Carlile, J. A., The Photography of Experimental Plants in the Studio. J. Biol. Photo. Assn. Vol. 7, No. 2, Dec. 1938, p. 59.

[12] St. Clair, Richard W. and Powell, Dawson, Essentials of a Photographic Laboratory. Photo Technique, April 1940, p. 14.

[13] Kodak Reference Manual, Eastman Kodak Company, 1940.

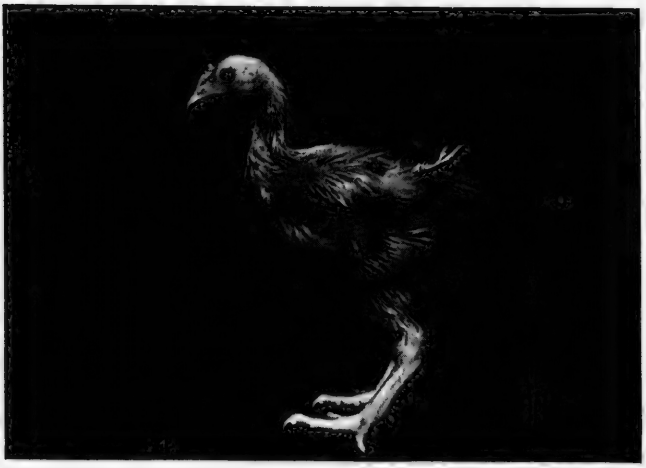
The scientific lecturer can give himself the same advantage by having his slides made a few days, instead of a few hours, before the deadline. No other department should feel that it has primary rights in the use of the photographic department. Trouble has often occurred when individuals purchase photographic equipment for a special project and "donate" it to the photographic department. It is better to avoid the obligation implied. Where another department furnishes equipment, a definite understanding should be made at the time the equipment is purchased. Costly equipment is often purchased by other departments without detailed inquiry into its purpose and actual worth. It is sometimes possible to adapt apparatus already on hand in the photographic department, and obtain satisfactory results.

SUMMARY

1. The rapid growth and wide variety of technics in scientific photography make the photographic department a logical part of an institution whose activities require graphic records for publication, for teaching and for demonstration.
2. The personnel and floor space in photographic departments at present is somewhat inadequate when the increase in volume of work and variety of technics is considered.
3. Careful planning throughout the department is essential; in architecture, in equipment and in organization of the steps in production.
4. The photographic department should have adequate administrative support, and should receive both financial and moral encouragement in extending the range of its services.

MOTION PICTURE FILMS

Motion picture films from the Film Depository of The Wistar Institute, Philadelphia, Pa., are now available for sale or rent by the authors. The deposit copies may be viewed for research or selection of teaching material at the Institute. In time the Institute will develop a clearing house for information about the better biological films and the Seal of Approval will mark superior films.



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Photographing Domestic Birds

by W. F. Lamoreux *

MANY anatomical characters can be better and more effectively described by means of pictures than in any other way, and since a wide variety of equipment and methods have been used for photographing live birds, this laboratory has been interested in satisfactory means of obtaining pictures which meet two principal objectives. First, the picture should emphasize the subject, or present the subject free from non-essential distractions. Second, the picture should illustrate the subject in sharp detail.

Material and Methods

In this laboratory, photographic equipment is used for two principal purposes. (1) It must produce slides in natural color and monochrome for teaching and for public lectures, and (2) it must produce pictures for half-tone reproduction.

The slides used are two inches square. This size was adopted because of its economy, particularly when colored transparencies are required, and because of its convenience for use when teaching. It is unsatisfactory, however, unless suitable projection equipment is available, and errors of photographic technique are more highly magnified upon the screen than with larger slides.

Pictures for half-tone reproduction have been made with film ranging in size from 35 mm. to 5 by 7 inches. These sizes each have

* Received for publication May 1, 1941 from the Dept. of Poultry Husbandry, Cornell University, Ithaca, N. Y.

Legends for Figures

Figure 1. This genetically naked chick was photographed against a background of black velveteen cloth. 5″ x 7″ Super Panchro Press film, f. 32, hand flash.

Figure 2. Since this black and white chick required a gray background, it was placed two feet from a white wall. Note the indistinct shadow obtained at this distance. A horizontal white reflector was used to lighten the lower part of the breast. Leica, 35 mm. Panatomic X film, f. 9, 1/60 sec., one reflector photolamp.

Figure 3. This dark brown Jungle Fowl (*Gallus gallus*) female was photographed before a light buff wall. To avoid shadows, the wall was illuminated. 5″ x 7″ Super-XX film, f. 32, Synchro-flash with one lamp on the bird, another on the background.

advantages and disadvantages. Those who, by choice or necessity, use the smaller sizes of film may profitably consider the statement by Cook[1], "I would guess that the proportion of Leica prints which would make acceptable five by seven half-tones would run a fraction of one per cent." Presumably he refers to the average photographer, but his statement does indicate that even the able technician may well maintain a hypercritical attitude toward his prints. However, this discussion is primarily concerned, not with the size or type of camera used, but with means of obtaining satisfactory pictures with available equipment. With this in mind, both 35 mm. and 5 by 7 inch negatives were used in making the accompanying pictures that illustrate techniques for attaining our two principal objectives.

Emphasize the Subject

Since grotesque shapes in the background distract attention, the most effective means of centering attention upon the subject is to have nothing else in the picture. This can best be done by the use of homogeneous backgrounds, which means that for most purposes pictures of individual birds should not be taken in poultry yards or pheasant pens. Occasionally one can place the bird on some object such as a covered barrel-head and, using the sky for a background, obtain a satisfactory picture out of doors. However, it is usually more convenient to take the birds to the laboratory where both bird and background can be more easily controlled.

A black background is very useful for birds that have light-colored plumage. A large piece of black velveteen cloth, free from prominent particles of dust, makes an excellent background that is free from shadows with any system of lighting. A similar, but smaller, piece can be used to cover the surface upon which the bird stands. This arrangement is especially effective for colored slides which, when projected in a dark room, show nothing upon the screen except the birds. The effect obtained in such pictures may be seen in figure 1. It should be remembered, however, that bright red combs may photograph so dark as to be barely distinguishable from the background unless suitable film or proper filters are used.

Since no shadows can appear in the black background of such a picture, it is possible to photograph birds with white feathers or down by using a single light. This facilitates the reproduction of texture by edging feathers, quills or strands of down with narrow shadows. Cross lighting tends to obliterate such outlines, with consequent loss of detail.

[1] Cook, Robert. Some Pictures are Worth Ten Thousand Words, But—! J. Biol. Photo. Assn., 8:135-140. March 1940.

If the use of a single light does not illuminate the feathers on the breast as much as desired, fig. 1, a white reflector can be placed in a horizontal position between the bird and the camera to produce the effect shown in fig. 2 without the cost of an additional lamp.

A gray background is sometimes useful for birds that are outlined in both black and white. This is readily obtained by the use of a white or light-colored background some distance behind the bird. Changing the distance between the subject and the background changes the tone of gray obtained and allows the photographer some choice. The control of shadows is also facilitated by placing the bird some distance in front of the background, fig. 2.

A white background is desirable and sometimes necessary for birds with dark plumage color, but tends to show pronounced shadows. It may be possible to remove these by placing the bird some distance from the background and arranging the lights so that the shadows fall below or to one side of the area to be photographed. Such an arrangement is frequently awkward, however, and the most satisfactory procedure has been to illuminate the background with sufficient light to obliterate the shadows. This is easily arranged when synchronized flash lamps are used by placing one lamp below and behind the subject to light the background, fig. 3. It is more difficult, however, to achieve the same result with photoflood lamps because several lamps are often required if one is to use a short exposure.

Sharp Detail

Fine photographic detail makes an excellent first impression by its apparent naturalness and sustains that impression by clearly indicating those characteristics of the subject which are being described. Technically, the production of excellent detail in prints depends, among other things, upon (1) accurate focusing of the camera, (2) the use of a lens aperture sufficiently small to bring the visible parts of the bird into relatively sharp focus, and (3) the use of a short exposure to prevent blurring of the subject as a result of movement. Each of these requirements, considered alone, is easily attained, but when the three are combined it is apparent that the photographer must frequently compromise with the ideal.

Accurate focus. A picture seems most natural when the whole bird appears to be in focus, yet this sometimes requires the use of a lens aperture so small that maximum resolution cannot be expected of the lens and some of the finer details of feather or down will be lost. This loss is usually less important, however, than the blurred heads, tails, and legs

that frequently result from the use of larger apertures. Since it is not easy to focus a camera upon a moving bird, the practice has been adopted of focusing on some inanimate object, or on a bird held by hand, at the place where the bird should be when the picture is taken. The aperture of the diaphragm is then reduced sufficiently to make all visible parts of the bird appear to be sharply in focus, making some allowance for movement of the bird. The subject is then posed in the position desired for the photograph. Wide aperture lenses are of no value for this purpose since it will usually be found necessary to use apertures of f.9 to f.32, depending upon the position of the bird and the focal length of the lens employed.

This procedure requires that the bird be posed at a prearranged location and within a very restricted range. Some birds will pose on a perch but many show a fear of falling and refuse to stand, particularly if the perch is a bit unstable. This fear seems to be reduced by standing the bird on a larger surface. Most domestic fowl can be persuaded to stand more or less naturally on a box or stand about a foot square.

Pheasants frequently refuse to stand on any kind of surface and for them a perch may be found quite useful. If the perch is short and fastened on a single post supported by a broad base, the bird can rest in a sitting position and be completely outlined against the background.

Shutter Speed. An exposure longer than 1/20 second is not very useful when live birds are involved. A few subjects may pose very well, but even the movements of respiration become apparent at slow shutter speeds. For most subjects, 1/50 second is a satisfactory exposure although occasionally one needs a shorter one. An important advantage in the use of synchronized flash lamps is the short exposure possible even at extremely small apertures. A standard exposure of 1/100 second has been found most satisfactory for our work when synchronized flash lamps are used.

The illumination required by the use of small apertures and short exposures is sometimes difficult to arrange satisfactorily, because it is not possible merely to increase the intensity of illumination and thus achieve satisfactory results. Particularly with slow speed films, the illumination desired requires so many photoflood lamps that the birds quickly become too warm, especially during summer weather. Some birds crouch or start turning away from the lights as soon as they are turned on, and even a quick exposure may catch a bird in motion. Because of these difficulties, it has been found most satisfactory in this laboratory to photograph live birds with synchronized flash-lamp illumination. The birds, posed in dim light, usually show no noticeable response to the flash. The strain upon the dispositions of those handling the birds has been greatly reduced, along with a considerable reduction in the time required to pose and

photograph any given bird. Besides the economy of time and labor, some saving of film is obtained because fewer negatives are spoiled by improper focusing, movement of the bird, or unsatisfactory posing.

The use of a multiple-flash has given all the latitude with respect to arrangement of lights that has been necessary, and has been particularly useful when a white background was desired. A flash-lamp placed behind the pedestal on which the bird stands will illuminate even a buff or light tan background so brightly that no shadows can be seen, fig. 3.

Discussion

The use of homogenous backgrounds, the control or elimination of shadows, the use of small lens apertures and short exposures is not dependent upon expensive equipment or upon the assistance of a photographic specialist. Most cameras, except the very cheapest, can be readily adapted to such work. There is no need for "fast" lenses, since their speed can seldom be utilized in getting good photographs of birds. A synchronizer for use with flash lamps is convenient and desirable if many pictures are to be taken, but even that is not essential. A cheap battery case and reflector unit can be used with lamps having a short flash if hand synchronization with the "open-flash-shut" technique is employed. Fig. 1 was obtained by this method.

The use of flash lamps may sometimes increase the cost of pictures, although in this laboratory the savings in film and in time are believed to offset this difference. Even if they did not, it is possible to justify some additional expenditure if it makes the difference between a good and a poor photograph for publication. The expense of obtaining experimental material and the cost of publishing illustrations are so great that the publication of poor pictures is usually not justified.

Rapid Preparation of Direct Positive Filmstrips for Lecture Aids

by Lorus J. Milne*

THE use of filmstrips and filmslides on 35 mm. film stock has grown so rapidly in recent years that few science departments or auditoriums are without suitable projectors. However, the preparation of filmstrips for specific lectures has often seemed a considerable task, since it involved making first a negative, then a positive print, or of complicated processing of expensive reversal film. One of the chief difficulties of the latter method was the step requiring uniform re-exposure of the film to a strong light, an undertaking almost impossible without special equipment to insure complete success. In the following account a method is described whereby inexpensive film stock may be reversed to a positive without re-exposure to light, and in little more time than that required for development of the usual negative. The whole process may be carried out conveniently in one of the common spiral reel developing tanks, which, after loading with the exposed film in the darkroom, is manipulated entirely in the light.

Organizing the illustrative material for a lecture is a normal preparation, whether it is to be presented by opaque projection or on a filmstrip. The filmstrip is certainly less awkward, more rapid, more luminous on the screen, less destructive to books containing the illustrations and much more conveniently portable. Photographing it on a strip of film stock is scarcely more trouble than inserting it in sequence in an opaque projector. It is the processing to a negative, drying, printing, processing the positive print, and the final drying time which deters most of us from preparing filmstrips for each of our major lectures.

By combining an assortment of recipes for photographic solutions, a positive ready for projection may be made directly from even the very inexpensive "Safety Positive" film normally employed only for making prints. The processing time is scarcely longer than that for usual negative development, and a single drying completes the undertaking. No time is taken in printing, processing a print, or drying it.

Two disadvantages are present in this method. If the filmstrip be scratched in use, a new one (or part) must be made, since there is no

* Received for publication March 1, 1941 from the Randolph-Macon Woman's College, Lynchburg, Virginia.

negative to fall back on. If the filmstrip be hardened after processing, it will not scratch easily with reasonable handling until used very many times. The other difficulty is that the latitude of the film is considerably less for reversal than for negative-positive production, since no compensation is possible. Those using 35 mm. cameras are already so familiar with the need for photo-electric meter calculations in exposing narrow latitude Kodachrome that the accuracy required will be no deterrent. Like Kodachrome, for reversal the Safety Positive film has a latitude of only one stop on each side of correct exposure before the finished film is either too transparent (over-exposed) or too dense (under-exposed).

I find for Eastman Safety Positive 35 mm. stock that calculations based on an emulsion factor of Weston 6 are best for exposures illuminated by 100-watt frosted bulbs in gooseneck reflectors, and an emulsion factor of Weston 8 (like Kodachrome in daylight) with No. 1 photofloods. The positive film is very responsive to blue light, so that the relative amount of these wave lengths in the light source is of great importance.

The following chemical treatment has produced many excellent filmstrips for me:—

1. *Developer* (Modified Agfa RD-1)—6 minutes with constant agitation at 18° C.

   Stock solution *A*. (Keeps indefinitely in corked bottles with little air.)

Water about 50° C.	500.0 cc.
Elon (metol, veritol, etc.)	2.0 grams
Sodium sulphite, desiccated	30.0 grams
Hydroquinone	12.0 grams
Potassium bromide	8.0 grams
Potassium thiocyanate (sulphocyanate)	5.0 grams
Cold water to make	750.0 cc.

   Stock solution *B*. (Keeps indefinitely in any stoppered container.)

Cold water (hot may boil and spatter)	200.0 cc.
Sodium hydroxide	18.0 grams
Cold water to make	250.0 cc.

   For use mix 3 parts of *A* to each part of *B* and make up only the quantity needed to fill the developing tank. This developer does not keep after mixing, hence should be discarded after once used, or after standing mixed for thirty minutes.

2. *Wash* not less than 5 minutes in running water below 20° C. Inadequate washing inhibits the action in the following bleach; a warmer wash water may allow the softened emulsion to leave the film base.

3. *Bleach* (*Dufay R-2*)—4 minutes with intermittent agitation at 18° C.
   Stock solution: (Keeps indefinitely in any stoppered container.)

Potassium bichromate ---------- 50.0 grams
COLD water to make ----------900.0 cc.
Sulphuric acid C. P. (add slowly) ----------100.0 cc.
For use dilute 1:10 with water. Discard after use.

4. *Wash* 3 minutes in running water.
5. *Clear* (Kodak R-9 B) of yellow stain left from bleach—5 minutes at 18° C.
   Sodium sulphite, desiccated ---------- 90.0 grams
   Cold water to make ---------- 1.0 liter
   This solution oxidizes readily and does not keep well. Prepare only the needed volume shortly before use, and discard after use.
6. *Wash* 3 minutes in running water.
7. *Reversal* (Dufay CR-1)—5 minutes with constant agitation at 18° C.
   Cold water ----------500.0 cc.
   Sodium hydrosulphite ---------- 10.0 grams
   Sodium bisulphite ---------- 14.0 grams
   Cold water to make ---------- 1.0 liter
   This solution must be very fresh. Weigh out the chemicals for the volume needed and mix while the film is washing after the clearing bath. They will dissolve readily and the action will be most rapid. Discard after use or after having stood mixed for 20 minutes.
8. *Wash* in running water. If the filmstrip is not to be hardened, it should wash for 10 minutes before wiping off excess water with viscose sponges and hanging up to dry. If the filmstrip is to receive much use and was difficult to organize, or is wanted to dry very quickly, it is worthwhile to add the hardening step and final washing. If this be done, 4 minutes is sufficient for the wash preceding the hardening.
9. *Hardening* (Kodak SB-3)—(optional; see above paragraph)—3 minutes with frequent agitation.
   Cold water ---------- 1.0 liter
   Potassium chrome alum ---------- 30.0 grams
   Prepare only the volume needed, since this solution does not keep well. Discard after use.
10. *Wash* 10 minutes in running water. At this stage the film is so well hardened that the wash water temperature is of little importance.

Total elapsed time for all steps is 48 minutes, of which 10 is the final wash. If wiped with viscose sponges and left in a dry room above 18° C. the film should be ready for projection in half an hour.

If bought at list prices for the smallest units on the market, the cost per 36-exposure strip will not be over half a dollar (film .14, developer .23, bleach .001, clearing bath .02, reversing bath .04, hardener .008). With an educational discount and by purchasing chemicals in larger quantities, the cost need not be over twenty-five cents for each 36-exposure strip finished ready for projection.

Motion Picture Photography of the Rectum and Rectosigmoid

by David Miller, M. D.* and Arthur Hinman

BEFORE going into this subject, one of us (D.M.) wishes to credit Joel J. Pressman, M.D. and Arthur Hinman[1], both of Los Angeles, for their very excellent pioneer work in the motion picture photography of the Larynx of the living human.

Photographic records of comparatively inaccessible parts of the body are of tremendous value in the present day practice of medicine both for matter of record and for use in teaching.

In teaching Proctology to the undergraduate students, practical demonstrations within the rectum and lower sigmoid of the living unanesthetized human has in the past not been very satisfactory. The field of view through any proctologic examining instrument is comparatively small. Demonstrations through a sigmoidoscope to such a group of students is not at all satisfactory, partly because of the small field seen and also because of the discomfort to the patient while maintaining the instrument in proper position long enough for each one of the group to observe what is being shown. And in order to recognize normal from pathologic areas in the bowel one must be able to manipulate the instrument so that these differences can be observed. Time does not permit the individual instruction of each of these undergraduate students in the art of passing a sigmoidoscope. Consequently the teaching of Proctology in the medical schools has fallen far behind as compared with teaching in other departments.

It was with this thought in mind, the improvement in teaching Proctology, that the idea of motion picture photography of the Rectum and Rectosigmoid was conceived. The set up we used has given very satisfactory results and is described as follows.

The camera can be any 16 mm type having a standard screw mount with operating speeds of 8 and 12 frames per second. One of the lighter weight models is preferable because it is easier to handle. We used a DeVry movie camera because it contained the above mentioned requisites and in addition is equipped with a direct view finder on the side, which

* Received for publication Jan. 8, 1941, Instructor in Proctology, College of Medical Evangelists, Los Angeles, Calif.

[1] Pressman, J. J. and Hinman, A. Simple Technique for taking Motion Pictures of Larynx in Action. Arch. Otolaryng. 26. 526-530, Nov. 1937.

permits sighting through the lens. This feature is quite an aid in focussing and in lining up the equipment.

Figure 1.

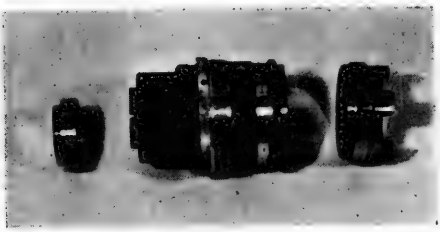

Figure 2.

Our greatest task was to obtain sufficient light inside the bowel and since this was not in excess we had to make use of a lens with the widest possible aperture. In order to obtain proper focus and magnification at such a short distance it was found necessary to mount the lens farther from the film than the usual position. These requirements were met in our arrangement by having one of the standard two inch lenses with an opening at fI.5 and mounted by interposing an adapter band ¼ inch wide between the camera and the lens. With this arrangement we were able to obtain a field of usable focus from 11 to 12¼ inches from the front of the lens and a sharp focus at 11½ inches.

The average sigmoidoscope is usually about 10 inches in length. We found that best visualization

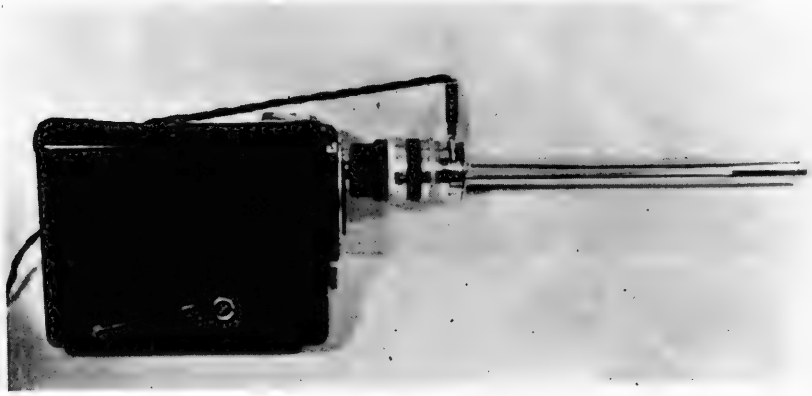

Figure 3.

was obtained when the distal end of the scope was kept ¼ inch from the object or area under observation. We, therefore, had made a collar ¾ inch wide, the proximal end of which threads into the front end of the lens and the other end of the collar so notched that it fit snugly over the light carriers and thus helps to maintain the collar flush against the proximal end of the sigmoidoscope while photographing. These figures can be varied according to one's individual arrangement.

Proper illumination was provided by two bulbs of the Welch Allen otoscope variety. These are inserted into the sigmoidoscope by means of two light carriers of such length as to give the maximum amount of light in the field of focus. The light carriers are inserted on opposite sides of the scope, as shown in figure 1. The adapter band, the lens and the notched collar are shown dissembled in figure 2, while figure 3 shows the parts all assembled and arranged, ready for taking pictures.

A point to be remembered is to have the lens warmed before using which prevents fogging due to the difference of temperature of the lens and the hollow viscera.

With this light-weight set up the entire procedure of examining the patient, aligning the equipment and taking the pictures is done by one person and that person is the examining physician. The sigmoidoscope is inserted in the usual manner and when the field to be photographed is found the light bulbs are stepped up to their maximum intensity by means of a rheostat, the camera with the assembled adapter band, lens and collar is placed flush against the proximal end of the scope, and the pictures taken.

Successful results depend upon one's ability to maintain the alignment of the camera and the scope. This requires a little practice. Of course cooperation between patient and operator is of prime importance. In our work we have had successful results with both black and white and Kodachrome A film.

A Light Dimming Unit

by Arthur L. Smith*

WHEN a piece of experimental equipment becomes an invaluable asset to laboratory photography, it seems appropriate to suggest its use to others. In a period when photographic literature is over abundant with descriptions of gadgets, it is advisable to be very sure that any new ideas in apparatus are definitely sound and useful. A year's trial of the dimming unit described in this paper assures me that it is not a gadget, but a most essential unit for any photographic laboratory that handles specimens which act adversely to extreme light and heat.

An electric unit involving a method of allowing floodlights to be dimmed as desired is not a new idea. The circuit involved in the dimmer I am going to describe has only one feature which makes it unique and different from those sold commercially at the present time. This is its versatility. I believe that its possibilities in use are more extensive than all other such devices with which I am familiar at the present time.

An apparatus for dimming lamps possesses several advantages. Lowering the intensity of the lamps while working lessens strain on the eyes. This is very important when considerable amounts of intense light must be utilized for long periods. Users of the popular photoflood lamps will find an economical advantage in the use of a dimming unit, as such bulbs have a much longer life when burned dimly. I have approximated that photofloods last about fifty times longer when kept dimmed except for the actual moment of exposure. The saving made possible by my own dimming unit made it possible to pay for building the apparatus within three months. The intense light and heat caused by flood lamps very often causes difficulty when photographing certain subjects such as live animals, specimens removed from fluids, and materials which are damaged by heat. Brilliant lamps used for photomicrography do not permit visual observation through the microscope unless some method of dimming is used. Certainly there are a sufficiency of excellent reasons for obtaining a good light dimming unit.

Originally, when contemplating the need for a light dimming unit, I outlined the various features which I would like to incorporate into it. My conclusions were that it should be a movable unit, have sufficient

* Received for publication March 6, 1941 from Cornell University, Zoology Dept., Ithaca, New York.

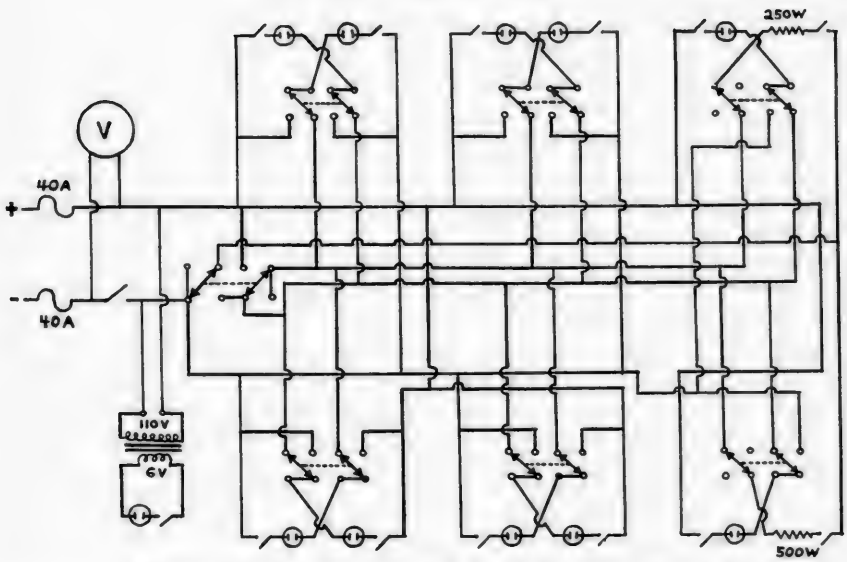

Figure 1. An eleven outlet light dimming circuit.

outlets for my needs, have a master dim-bright switch, have dim-bright switches for lamp pairs, have individual outlet switches, and that it would meet standard electrical specifications. I found that to do all these things was possible, though it involved a complicated circuit and special switches. The basis for the circuit is the series-parallel connection of lamps. A bulb connected in "parallel" receives current in the customary manner. However, when two bulbs are connected so that current flowing from one pole passes through both lamps before reaching the other pole, they are in "series" and an effective resistance is obtained. If two lamps are connected in such a manner that a switch can permit current to pass through the lamps either in series (dim) or parallel (bright), the switch provides a simple but

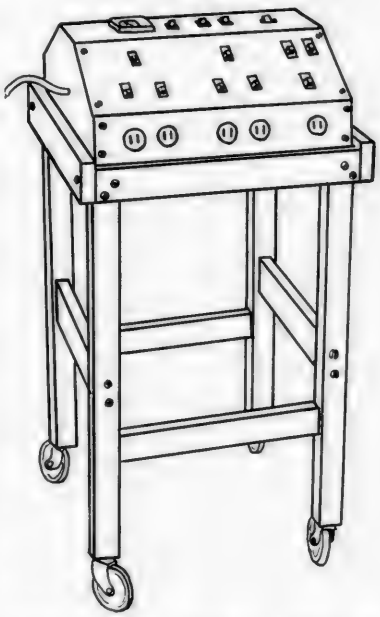

Figure 2. A movable stand and control box into which the unit may be built.

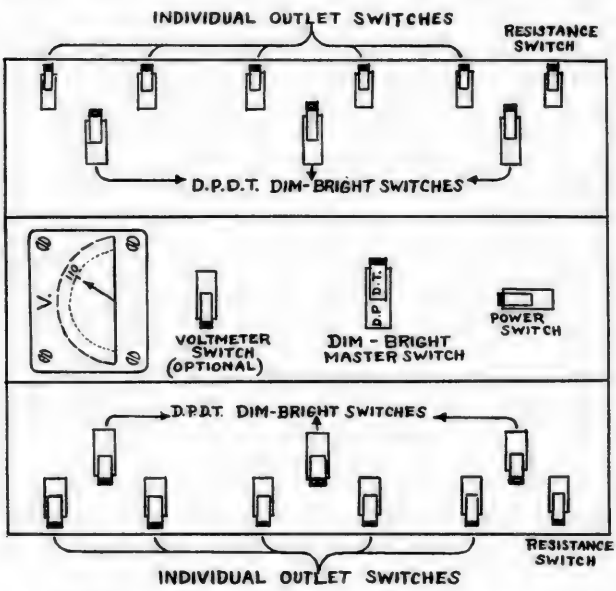

Figure 3. Diagrammatic view of switch positions for a ten outlet dimming unit.

effective method changing from bright to dim. Any number of pairs of lamps can be incorporated into a unit.

The disadvantages of having to throw a switch for every pair of lamps may be seen in the example of the time when an active and restless animal is posed under dim lights. If six lights are being used, the time required to throw three switches is often enough to allow the animal to react to the extreme light and heat. Thus, by the time that all the lights are brought to brilliance, the animal is apt to be somewhere else. This difficulty can be avoided by using a master switch which will bring all the lamps into full brilliance with one motion. The switch used for this purpose is of the double pole double throw type and experience has proved it to be the most important feature of the circuit.

The number of outlets incorporated into the unit is dependent upon individual needs. The number of outlets illustrated in the following diagram is eleven, but the principle of the circuit can apply to either more or less. Eight of the outlets shown are divided into pairs for series-parallel connection with each other. Two of the outlets are connected to wire coil resistances in order that odd numbers of lamps may be used. Each of these two single outlets are connected with resistances of different wattage. One is of approximately the same wattage as employed by the number one photoflood bulb. The other accommodates number two photofloods.

The above circuit would probably be adequate for most laboratory needs. In addition to the regular outlets, it will be noticed that there is an outlet which supplies six volt current. Many laboratory instruments,

such as small spotlights and microscope lamps employ six volt current. A transformer connected into the circuit can supply six volt current to a specially marked outlet. A voltmeter has also been included in the unit, though it is entirely optional. In many areas there are voltage drops during the day, due to increased current consumption. This difference in voltage causes a variation in the color temperature of the photoflood lamps used for exposing indoor Kodachrome A film. The voltmeter may be used as a means of determining when optimum conditions are available.

A second type of circuit in which every lamp has an individual resistance is shown in figure 4. It accomplishes the same purpose as the circuit shown in figure 1. The resistances chosen must be of approximately the same wattage as the lamps to be used. A variety of resistances could be included and their wattage marked on the individual outlets.

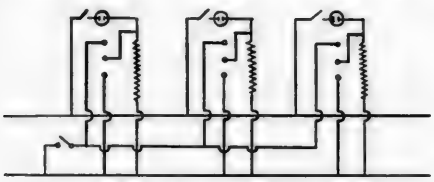

Figure 4.

I need not dwell on the constructional detail of the unit, except, perhaps, to mention that the current should be drawn from an adequately heavy outlet. (A 40 ampere polarized outlet was used for the circuit described in figure 1). Toggle switches are preferable to other types. All switches should be heavy enough to carry the maximum load going through them, of course, and the current wire from the power outlet should be about 8 gauge. All switches, except the individual outlet switches are double pole double throw switches. Fire underwriter's regulations make it necessary that the unit be able to pass official inspection.

Duplicating Color Slides

by Stanley J. McComb*

THE biological photographer frequently is asked about the possibility of duplicating a treasured Kodachrome, or the making of enlarged Kodachrome slides from 35 mm., or even 16 mm., film. Kodachrome originals can be duplicated by the average photographic technician if consideration is given to a few factors which affect the color and quality of the duplicate. These factors are (1) proper color temperature of the illuminant and (2) proper exposure of the film.

As Kodachrome Type B is adjusted to give a correct color rendering with lamps operating at a color temperature of 3,200° K., it naturally follows that this factor must be adhered to. Securing the proper color temperature may be achieved by several methods, when lamps which have a color temperature other than 3,200° K. are used. The Eastman color compensating filters may be used when the deviation from 3,200° K. is not too great. These are available in varying pale hues of yellow and blue. If the lamp emits a higher color temperature than 3,200° K., a yellow filter should be used; if the lamp has a lower color temperature, a blue filter should be used. A color temperature meter or test exposures on Kodachrome may be used in order to determine proper color temperature.

Altering line voltage to the lamp by a resistance or variable transformer is another way of changing color temperature. As all lamps are designed to operate at certain voltages, any deviation from that voltage will affect color temperature. A higher voltage will cause the light to be whiter, and a lower voltage will cause the light to be more red and yellow. The latter is unsuited to Kodachrome Type B.

The Eastman Kodak company lists the color temperature of various light sources as follows: 60 watt vacuum tungsten filament lamp 2,509° K., 100 watt gas filled tungsten filament lamp 2,865° K. and 250 watt No. 1 photoflood lamp 3,444° K.

The opal bulbs generally supplied with modern enlargers have a suitable color temperature for use with Kodachrome Type B.

Exposures on Kodachrome must be as accurate as possible if correct rendition of color is to be obtained. Therefore, a reliable method

* Received for publication May 5, 1941 from the Photographic Dept., Mayo Clinic, Rochester, Minnesota.

for determining exposures must be adopted. If just a few duplicates are to be made, a test method using Portrait Pan film may be used. Recommendations for this are given in the instruction booklet included with each package of Kodachrome. When a great number of duplicates are to be made, the work is expedited considerably by the use of an enlarging photometer or exposure meter of the "grease spot" type. It is necessary to determine a speed rating for Kodachrome by test exposures, first on Portrait Pan, and then, within narrow limits, for Kodachrome for the presetting of the photometer.

The technic used in this department for the making of 3¼ by 4¼ Kodachrome slides from 16 mm. Kodachrome cine film might be of interest. A 35 mm. enlarger, the opal bulb of which is suitable for Kodachrome Type B, is fitted with a hood which excludes all extraneous light from the darkroom. A mask with an opening just the width of the 16 mm. film and several frames long is inserted in the film channel. This removes all stray light which otherwise could cause partial fogging of the film and general lack of brilliance. From a rewinder the film is led, emulsion side up, from the reel over the mask in the film channel, the film is centered and the projected image is focused on a white card in a 3¼ by 4¼ film holder which is "nested" in a corner of the enlarging board. The exposure necessary is determined by placing the disk of the photometer in a representative area of the projected image and the time read directly from the scale after making the necessary adjustments. With the enlarger light off, a holder containing Kodachrome Type B is substituted for the one containing the white card, the dark slide is withdrawn and the exposure is made by turning on the enlarger light for the required time. Enlargements up to ten times are obtained without serious loss of definition.

The same technic can be used in enlargement of 35 mm. Kodachrome or for making 35 mm. slides from 16 mm. film.

We have had occasion also to make Kodachrome duplicates of the same size, 3¼ by 4¼; for this we used a ventilated box containing four 25 watt Mazda bulbs, with an opening over which was placed the Kodachrome to be copied. The proper color temperature for Kodachrome Type B was obtained by connecting the four bulbs to a variable output transformer and raising the voltage from the rated 115 to 135 volts. An opal glass placed over the opening diffused the light and eliminated "spottiness." It was necessary to use a color correcting filter with this light of greater correcting value than was offered by the Color Compensating Filters. The Dufay flash filter, which we have used with success in photomicrography, proved satisfactory in this connection. Other

possible filters are the Wratten photometric filters Numbers 78, 78A, 78B, 78C, the Finlay flash filter and the Finlay Mazda filter. The use of any one of these filters necessitates a longer exposure, the factor of which can be determined only by test.

Bulbs of higher wattage could be used with equal success, even a photo flood lamp, with or without a correcting filter, depending on the line voltage.

The box with the Kodachrome emulsion side down and masked to eliminate stray light, was placed in front of a camera and the lens racked out to twice its focal length for an image of the same size. An exposure meter reading was taken with the meter directly over the transparency and the indicated exposure, at whatever diaphragm is selected, was multiplied by four, as necessitated by the double extension of the bellows. The exposure was made with a camera shutter in the usual way.

These technics could well be extended to old lantern slides made by other color processes, as the Lumiere, Agfa, Finlay and Dufay. Many beautiful Agfa and Lumiere color slides were made from material which is now rare but were too dense for satisfactory projection. These can be copied on Kodachrome under brilliant illumination, and with a prolonged exposure to obtain a transparency of the proper density for projection.

In the case of Finlay color slides, the viewing screens used with this process fade if exposed to the projection light over a long period of time, resulting in loss of brilliance as well as poor rendition of color. An additional disadvantage of this process is the tendency toward loss of register if the slides are handled a great deal.

By copying these slides on Kodachrome, using a new viewing screen instead of the faded one, a more permanent color record can be obtained, in which the difficulties inherent in this process are eliminated.

In general, copying slides of this type requires exposure beyond that necessitated by (1) the increased bellows extension and (2) the multiplying factor of the color correcting filter. Some slides copied in this department required a quarter and even a half more exposure than was indicated by an exposure meter reading.

For the successful copying on Kodachrome, the color temperature of the light is matched to the type of Kodachrome being used; the transparency to be copied is masked in order to eliminate stray light, and a reliable method for determining exposures should be used.

When the original color is slightly "off," slight correction can be obtained by the use of a color compensating filter; one of the blue filters should be used for a too yellow original and a yellow filter for a too blue original. This, however, is largely a matter of experimentation.

These methods suggest the possibility of "saving" under-exposed Kodachromes by copying them under brilliant illumination of the proper color temperature. With adequate exposure, the resulting color should have added brilliance and clarity.

HEADLINES ANNOUNCED FOR PROFESSIONAL PHOTOGRAPHY'S GREATEST ANNUAL EVENT

The Executive Board of The Photographers' Association of America announces a talk and demonstration by John Paul Pennebaker, of the Underwood & Underwood Illustration Studios, Chicago, as one of the features for its coming 54th Annual Convention, to be held at the Stevens Hotel, Chicago, Ill., from August 18 to 22, inclusive. "Solving Some Tough Ones for National Advertising," will be Mr. Pennebaker's subject. First a portrait painter, then a portrait photographer and finally an illustrator, Mr. Pennebaker has had a varied career. As an illustrator, he became noted for his striking photomontages; he was the first American illustrator to use photomontage seriously in advertising photography.

Another headliner, of equal note but in an entirely different field, will be Ken Hedrich, of the famed architectural photographic firm of Hedrich-Blessing, also in Chicago. His contribution will be an illustrated talk entitled the "Rights and Wrongs of Architectural Photography." Mr. Hedrich will confine himself to problems which affect the every-day commercial photographer who has to handle the occasional architectural job in his vicinity.

This year the Business Promotion and Photo Finishing Programs will not be presented from the platform but will, instead, appear in the form of articles in the final Convention Report. The beauty of this plan is that members will receive valuable suggestions and ideas and yet will not miss other features such as demonstrations which the reporters cannot take down satisfactorily for publication.

News From the Trade

News from Bell & Howell

Bell & Howell announces that sound films now may be run on all new 16 mm. Filmo silent projectors. The sound, of course, will not be reproduced, but there is now open to owners of this popular projector a vast new field of entertainment and educational films. No longer need the owner of silent equipment be prevented from enjoying interesting and instructive films available only in sound versions.

News from E. Leitz, Inc.

Since the introduction of the Leitz Cover Glass Plates with Ground Edges, these plates have attained extremely wide usage. Many professional and scientific laboratories who make numerous 1 x 1½ inch color transparencies have found that the ground edges of the Leitz Cover Glass Plates permit slides to be made with greater rapidity, make the final slide neater in appearance, and result in bound slides which are more uniform in size. As a convenience to those who make large numbers of slides, the Leitz Cover Glass Plates are now available in a special "Laboratory Packing" which contains 600 glass plates. This package lists at $7.00.

News from Agfa Ansco

Newest member of the family of professional films manufactured by Agfa Ansco is *Triple S Ortho.* The emulsion of this new film exhibits a combination of extreme speed and high orthochromatic color sensitivity, together with an essentially long-scale, yet moderately-brilliant portrait graduation. Other features of interest include: a back-coating for halation prevention; an anti-abraision matte surface-coating that facilitates negative retouching; and a spectral sensitivity that permits development with occasional inspection by red safelight.

New Improved Indiatone Paper: The warm-toned Indiatone paper which has been widely employed for both projection and contact printing is now being supplied by Agfa Ansco in a new, improved type. In addition to being richer in tone and easier to handle than that previously supplied, the new Indiatone displays excellent stability and latitude characteristics and is marked by an improved gradation that exhibits a softer highlight detail without sacrifice of shadow brilliance. The Indiatone emulsion is supplied in one grade on seven attractive surfaces.

New Agfa Film Introduced for Photography of Fluorescent Screens: A new Agfa film has been perfected which is ideally suited to the direct photography of fluorescent screens. Known as Fluorapid, the new emul-

sion will be available in various lengths of perforated 35mm. film stock. Main application of the new Agfa Fluorapid film will be its use in large-scale x-ray surveys, where small-size records of x-ray examinations are preferred for reasons of economy and filing space.

Regularly available sizes of Fluorapid film will include 5½-foot spool, 36-exposure Leica-type cartridge, 250-exposure Leica .FF spool, and 33- and 100-foot bulk lengths.

Agfa Ansco Adopts 68° Temperature Standard in Developing Recommendations: After lengthy study of all factors involved, a new temperature standard has been adopted by Agfa Ansco, specifying a value of 68° Fahrenheit (20° Centigrade) for the development of Agfa films and papers. Recommendations have formerly called for a developing temperature of 65° F. with films, 70° F. with papers.

News from The Edwal Laboratories Inc.

The faster speed of Edwal's New Quick Fix saves four-fifths of the time usually required by ordinary hypo fixing baths. A negative can be cleared in 55 seconds and completely fixed and hardened in three minutes. Quick Fix is economical too. A working solution will process at least twice as much film as an equal volume of a standard fixing bath.

News from Wabash Photolamp Corporation

Two new color flashbulbs now available. With more and more photographs turning to natural color photography, the need for smaller size, lower-priced color corrected flashbulbs for all types of cameras including focal plane, has been keenly felt. To meet this increasing demand, the Wabash Photolamp Corporation, Brooklyn, N. Y. has put out two new small size, blue color bulbs, the Nos. OB and 4OB.

These two new bulbs are said to be the first color-corrected flashbulbs that can be used with all cameras including the focal plane types. Their self-filtering blue jackets entirely eliminate the need for any separate filters when shooting either indoors or outdoors with daylight type color film, or daylight-corrected one-shot color cameras. By coating the inside of these bulbs with a special crystal-clear, daylight blue lacquer, to act as a self-contained filter to color correct the light emission, it has been possible to convert the color temperature of the light from 4,000° to 6,000° Kelvin, the equivalent of sunlight.

Thus, balanced with sunlight, the bulbs are particularly useful in synchro-sunlight color photography, where they serve as boosters to throw much needed light into the dense shadows cast by the sun.

Because of the smaller size and lesser light output of these two new bulbs there is considerably less danger of blocking up highlights, a fault which easily occurs if too large a bulb is used.

Association News

The Eleventh Annual Convention

The eleventh annual Convention of the Biological Photographic Association will take place September 11, 12, 13, at the Hotel Buffalo, Buffalo, New York. Every effort is being made to make this program an outstanding one. The rates for rooms at the Hotel Buffalo are as follows: Single from $2.00 to $3.00 per day; double with double beds $3.00 to $5.00 per day; double with twin beds, $4.00 to $6.00 per day, and additional beds in any of these rooms will be furnished at $1.50 per day each; suites, parlors, bedrooms and baths — from $5.00 to $9.00 per day. Breakfasts are from 25 cents up; luncheons from 50 cents up; and dinners from 85 cents up.

The Hotel Buffalo is located in the heart of downtown Buffalo, where theatres and restaurants are close by. Any additional information can be obtained about hotel accommodations by writing the manager of Hotel Buffalo.

The Hotel is within walking distance of the Greyhound Bus Terminal and of the boats that dock in Buffalo. There is a private bath in each room, circulating ice water, and radio reception. It would perhaps, be wise to make your reservations as soon as possible to avoid other conventions that will take place in Buffalo at the same time.

A trip to Niagara Falls, which is 18 miles distant from downtown Buffalo, can be arranged for those attending the Convention. If you would like to make this trip, get in touch with the Convention Chairman. Americans have no difficulty entering the Dominion of Canada, and anyone that would like to see the Falls from the Canadian side, can do so.

Mr. Nat Horton of Montreal, Canada, is Chairman of the 1941 Salon, but those wishing to enter prints should send them direct to William F. Payne, 663 North Oak Street, Buffalo, New York. We ask your cooperation by sending these prints as soon as possible so that sufficient space and backgrounds can be provided. The X-ray competition, started last year, is still in progress. However, one of our members has the X-ray film and has neglected to forward it to the next contestant. If, by chance, you happen to be the member, will you kindly set the film in motion again as there are a number who still would like to copy the X-ray. We have been unable to locate the X-ray film.

It would be of considerable assistance to the program committee if each member would write to the Convention Chairman, expressing his desires for a certain type of paper. If you have a photographic problem,

we feel sure we can obtain a speaker on such a subject. This will make the program committee's job much easier. Some of the subjects suggested are as follows:

1. Sound in medical motion pictures
2. A new film sensitized to flueroscopic light
3. Photographic lenses
4. Photographs and their value in public health education
5. Photomicrography in kodachrome
6. The comparison microscope in ballistics identification
7. The electronic microscope
8. The kodatron
9. Prints by projection and contact
10. Portraiture of men and women in white
11. Photography in the air service
12. Hand lettering made simple
13. Photography in a modern museum
14. A demonstration of the air brush
15. At least an hour to be given on these two subjects, "How to do" and "How to Make." (suggested by Dr. Proetz.)

The following I quote from Dr. Proetz's letter. "In the view of the demands shortly to be made by the defense agencies, no doubt many of our members will be called upon to do photographic work which has previously been out of their field. Perhaps this kind of program will be very useful to our members."

All information pertaining to the Convention should be sent to Mr. William Payne, Convention Chairman at 663 North Oak Street, Buffalo, or to Miss Anne Shiras, Secretary of the Association.

Arrangements are progressing nicely. But we do ask your cooperation by making reservations early and by suggesting to the Convention Chairman the type of papers you would be most interested in.

1941 Salon

If every member of the Association would make a note right now to submit even two prints, we could have, probably, the most outstanding exhibition of biological photographs ever viewed in these United States. Unfortunately it becomes more apparent each year that only a very small percentage of our membership is represented at these Annual Salons . . . can't we start a "New Deal" this year and have a Salon that really represents the work of the many highly skilled men and women of our Association.

It can be done . . . and it is a comparatively simple problem if you will make a note right now on your work agenda: "Make up selection of prints for B.P.A. Salon." Easy to write and certainly not difficult to do, so please give your fellow members a break and let them see what YOU have been doing in photography.

Attendance at the Annual Meeting may be for a variety of reasons, but certainly one point on which most of us will probably agree is the desire to hear about and see what contemporary workers are doing. One of the very best ways in which you as a member of the Association can contribute to this interchange of ideas and information is to exhibit your own work. Remember that it has often been said, "One picture is worth a thousand words." Maybe this isn't always literally true, but it certainly does help. May we count on seeing your pictures at the Salon?

SALON DATA

All entries must be in the hands of the Salon Committee by September 5, 1941. Please send all material to Mr. William F. Payne, 113 High Street, Buffalo, New York. No entries will be accepted after the closing date. Any package that must go through the customs should be plainly labeled: "Photographs for Exhibition — Not for Sale — No Commercial Value — May be opened for postal or customs inspection." An acknowledgement of the arrival of each package will be made by mail.

Prints. Mounted, preferably, on light coloured stock measuring 16 x 20 or 12 x 16. When a series of prints illustrating one subject is shown, as many prints as convenient should be placed on one mount. All pictures should be precisely captioned. Short descriptions of technic and lighting diagrams should be given wherever a particular problem is being illustrated. The name and address of the exhibitor must appear on the back of each mount; it should also appear in a suitable manner on the face of the mount.

Transparencies. Lantern slides 3¼ x 4 or 2 x 2. Either size is eligibile, but they must be mounted ready for projection. No film strips can be accepted. Each plate must carry the name of the exhibitor as well as a marker indicating the correct position for placing in the projector. All the accepted entries will be shown at a special evening projection session.

The Salon Committee reserves the right to reproduce any of the exhibit material in our JOURNAL and to give permission for the publication elsewhere of selections from the Salon. Reasonable care will be taken of all entries submitted, but the Committee will not be responsible for damage or loss.

On the back of each print exhibited, a suitable label will be placed indicating that it was accepted by the jury.

The prints selected and hung will constitute the Annual Traveling Salon, which will be exhibited throughout the United States.

The A. M. A. Convention

As we go to press, our exhibit for the A.M.A. Convention to be held in Cleveland June 2-6 is being assembled. The response from the membership has been good and we wish to thank the contributors for sending material in the midst of a busy spring season. Our purpose in holding this exhibit is to stress the standards of good medical photography, and to place the B.P.A. before the medical profession as a source of information on photographic techniques.

As it is the policy of the A.M.A. to list all exhibits under the name of an individual, it was necessary to enter our booth under the secretary's name in the program and in the list for official booth-signs supplied by the A.M.A. The signs and the work inside the booth however will stress the national character of the Association. Full credit will be given under each picture to the photographer and his institution.

The work which contributors have asked to have returned will be sent back promptly after the exhibit. All other material will be retained by the Association and a part of next year's Salon will be given over to it.

NOTICE

The B.P.A. Journal on Microfilm

The first eight volumes of our JOURNAL have been photographed by the American Documentation Institute. Positive microfilm copies of articles may be obtained at a rate of one cent per page plus a service charge of 20 cents. Photoprint enlargements, 6 x 8 inches on paper, are 10 cents per page plus a service charge of 20 cents. Positive microfilm copies of the entire set of eight volumes, if ordered at one time, can be supplied at the special rate of approximately three-fourths cent per page or $14.00 for the set. Spools are extra if desired.

Orders will be filled by the Bibliofilm Service, c/o Library, U.S. Department of Agriculture, Washington, D. C. They must be accompanied by order blanks giving complete information as to pages, volume, etc. Blanks containing the Association's order-number may be had from the Secretary.

The microfilm negative is a gift of the Pittsburgh Chapter to the national B.P.A.

CHAPTER NEWS

Judging from their notices the Chicago Chapter has had a busy winter, with reports from various members on methods of copy, photography in dermatology, photography of body cavities and many other subjects. One thing the chapter has done is to study the technique of stereoscopic photography. Some of their recommendations in this field will appear in the JOURNAL.

The Pittsburgh Chapter devoted three of their meetings to papers on sensitometry and photographic chemistry. For the rest, they covered a wide variety of subjects, including photography with the electron microscope. They joined in organizing a united front against an ordinance proposed by the local Motion Picture Operators' Union which would have greatly limited the use of 16 mm. films without a licensed projectionist. The ordinance was withdrawn before the matter was put to the vote of the council.

The Boston and Philadelphia Chapters had not been heard from as we went to press.

THE EFFECTIVE USE AND PROPER CARE OF THE MICROSCOPE

Oscar Richards, Ph.D., Research Biologist for the Spencer Lens Company, has written an excellent treatise on "The Effective Use and Proper Care of The Microscope." The purpose of this illustrated booklet is to acquaint the user with the nature and possibilities of the microscope, some of its limitations and brief instructions for the use and care of the instrument. A select bibliography is given to save considerable effort and much time for the researcher by studying the experiences of other microscopists.

Dr. Richard develops his dissertation from elementary methods to advanced technic; from preparation of materials to special methods and recording observations. A chapter well noting in this book is "Accessories for the Microscope," which suggests mechanisms for simplifying microscopic work.

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We take pleasure in announcing the following new members:

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